



The City of New York
Department of Environmental Protection
Bureau of Wastewater Treatment

**POST-CONSTRUCTION
COMPLIANCE MONITORING
AND
CSO RETENTION FACILITY
OVERFLOW SUMMARY
FOR
CALENDAR YEAR 2012**

AUGUST 2013

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1.0 INTRODUCTION

1.1 REGULATORY CONTEXT

In accordance with State Pollutant Discharge Elimination System (SPDES) permits and Combined Sewer Overflow (CSO) long term control plan (LTCP) processes, the New York City (NYC) Department of Environmental Protection (DEP) has herein compiled performance-related information for the City's four CSO retention facilities that operated in calendar year (CY) 2012:

1. Spring Creek CSO Retention Facility (SPDES No. NY-0026212), located at 127-20 Flatlands Ave. in Brooklyn and operational since 1972;
2. Flushing Bay CSO Retention Facility (SPDES No. NY-0026239-010), located at Fowler Avenue in Queens and operational since June 2007;
3. Alley Creek CSO Retention Facility (SPDES No. NY-0026239-025), located at Northern Blvd. and Alley Creek in Queens and operational since March 2011; and
4. Paerdegat Basin CSO Retention Facility (SPDES No. NY-0026182), located at 1887 Ralph Avenue in Brooklyn and operational since June 2011.

The collected performance information is intended to address two requirements, as follows.

- Post-Construction Compliance Monitoring (PCM): monitoring and analysis of water quality in the receiving waters (see Section 2.0 – Collection and Modeling of Water Quality Data in the Receiving Waters); and
- CSO Retention Facility Overflow Summary: facility overflow quantification and effluent quality monitoring and modeling (see Section 3.0 – Facility Operations, Flow Monitoring, Modeling and Effluent Quality).

A number of regulatory documents¹ set forth the approach to PCM for these facilities.

¹ The documents describing the requirements and technical approaches for the Post-Construction Compliance Monitoring and CSO Facility Overflow Calculation include the following.

- *Calculation of Combined Sewer Overflows From Remote Control Facilities*, March 2004

- *Jamaica Bay and CSO Tributaries Waterbody/Watershed Facility Plan*, draft June 2007

- *Flushing Bay and Flushing Creek Waterbody/Watershed Facility Plan*, draft June 2007

- *Paerdegat Basin Waterbody/Watershed Facility Plan*, draft June 2006

- *Flushing Bay/Creek and Spring Creek Retention Facilities Interim Post-Construction Monitoring Plans*, January 25, 2008 (DEC Case #CO2-20000107-8, per DEC approval letter dated March 13, 2008)

- SPDES permits (Section VIII) for 26th Ward, Tallman Island and Coney Island WWTPs (November 1, 2010)

The Interim Post-Construction Monitoring Plans, the SPDES permits for the 26th Ward, Tallman Island, and Coney Island Waste Water Treatment Plants (WWTPs), and the LTCP Waterbody-Watershed Facility Plans (WWFPs) require summary reporting of CSO retention facility overflow monitoring data in conjunction with the CSO BMP Annual Report.

The following sections summarize the monitoring data collected from the CSO retention facilities and their respective receiving waters. Modeling activities and related calculations as well as more complex facility performance analyses are also provided.

1.2 TECHNICAL APPROACH

PCM, inclusive of CSO Retention Facility Overflow Monitoring, is integral to the optimization of CSO Retention Facilities because it provides facility-performance data as well as other information valuable for validation of the model, which in turn aids in the evaluation of benefits that are achieved by the facilities. This report addresses the monitoring for the four CSO Retention Facilities, as well as the analyses of facility performance based on sewer-system and water-quality models.

1.3 NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION COMMENTS ON THE CY2011 *POST-CONSTRUCTION COMPLIANCE MONITORING AND CSO RETENTION FACILITY OVERFLOW SUMMARY* (MARCH 2012)

DEP has not received comments from the New York State Department of Environmental Conservation on the CY2011 PCM report.

2.0 COLLECTION AND MODELING OF WATER QUALITY IN THE RECEIVING WATERS

This section summarizes the water quality data collected in the receiving waters impacted by the Spring Creek CSO Retention Facility (i.e., Spring Creek and nearby Jamaica Bay), the Flushing Bay CSO Retention Facility (i.e., Flushing Creek and Flushing Bay), the Alley Creek CSO Retention Facility (i.e., Alley Creek and Little Neck Bay), and the Paerdegat Basin CSO Retention Facility (i.e., Paerdegat Basin and nearby Jamaica Bay). An analysis of the impact of the CSO retention facilities on water quality in these receiving waters is also presented. Section 2.1 presents findings for waters impacted by the Spring Creek facility. Section 2.2 presents findings for waters impacted by the Flushing Bay facility. Section 2.3 presents findings for waters impacted by the Alley Creek facility. Section 2.4 presents findings for the waters impacted by the Paerdegat Basin facility.

2.1 WATERS IMPACTED BY THE SPRING CREEK CSO RETENTION FACILITY

2.1.1 Water Quality Monitoring Results – Spring Creek

Post-construction compliance monitoring for the Spring Creek CSO Retention Facility consists of sample collection mid-creek near the Belt Parkway Bridge (station SP1) and at the mouth of Spring Creek (station SP2). DEP's Harbor Survey program samples water quality at a location near the mouth of Spring Creek in Jamaica Bay (station J8); those results are also included in the analysis. Figure 2-1 provides a map of the tank and sampling-station locations.

The monitoring results are tabulated in Appendix A and shown on Figures 2-2 to 2-5. Results are shown for dissolved oxygen (DO), fecal coliform bacteria, enterococci bacteria, and total suspended solids (TSS). On each plot, the top panel shows the daily rainfall for 2012 (at JFK Airport). The second panel shows reported retention facility overflow volumes. The third panel shows the results for station SP1, and the bottom panel shows the results for the SP2 and J8. The applicable New York State (NYS) water quality standards are shown on each panel. The applicable water quality classification is Class I at stations SP1 and SP2 (both of which are located in Spring Creek), and Class SB at J8 (which is located in Jamaica Bay).

On Figure 2-2, the DO-monitoring results in Spring Creek (at SP1 and SP2) show three excursions below the applicable standard (≥ 4.0 mg/L) at SP1 and one at SP2. In Jamaica Bay, the measured DO concentrations were generally above the chronic standard of ≥ 4.8 mg/L, but excursions below 4.8 mg/L occurred from July through September. In addition, one excursion below the acute standard of ≥ 3.0 mg/L was measured in August.

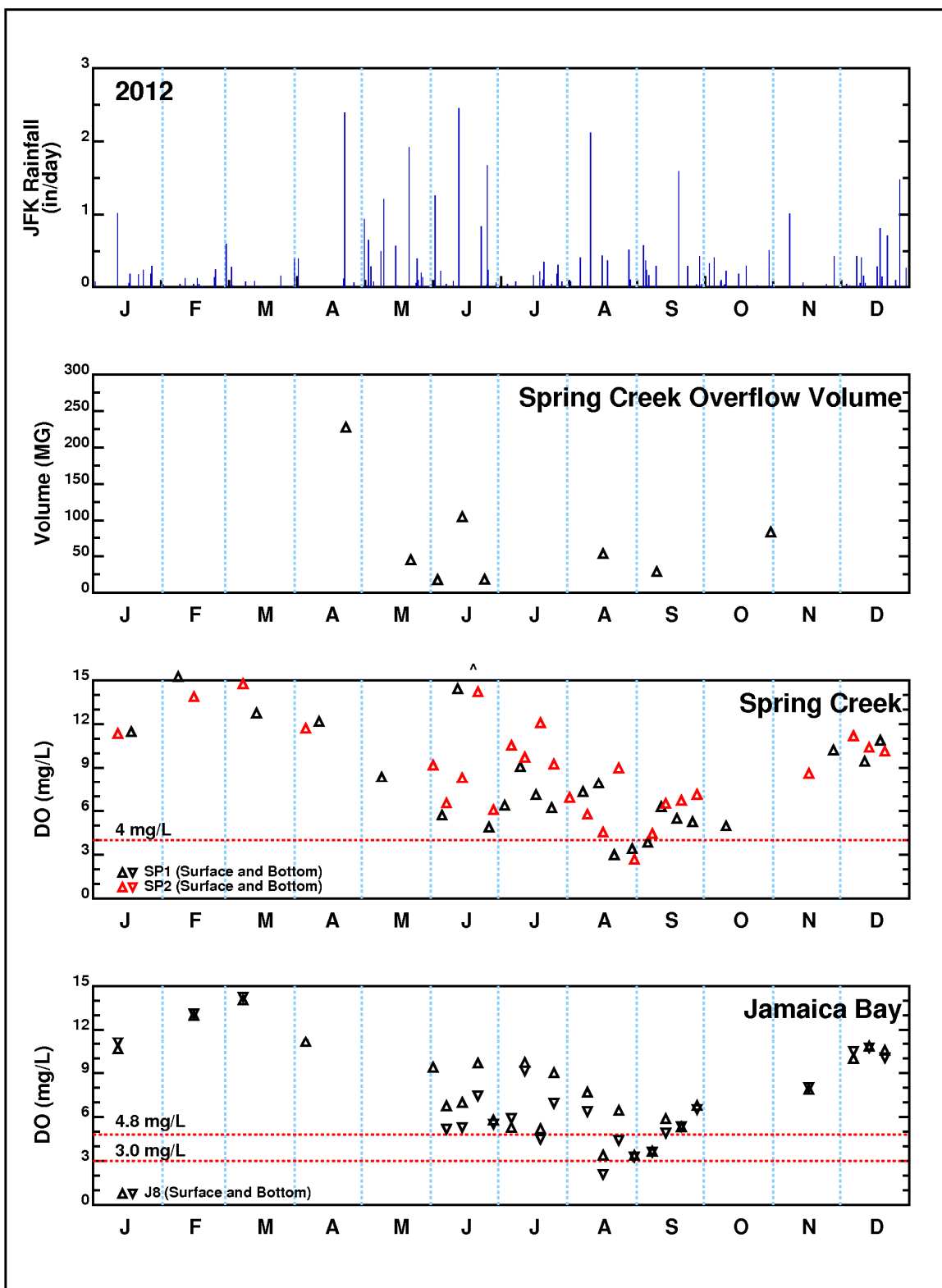
Figure 2-3 presents discrete samples of fecal coliform at stations SP1, SP2 and J8. In Spring Creek, observed concentrations met the Class I standard (monthly geometric mean, from a minimum of five examinations, not to exceed 2,000 cells/100mL). The three discrete fecal coliform measurements greater than 2,000 cells/100mL did not occur often enough to result in excursions from the standard. In Jamaica Bay, there were many discrete measurements above the Class SB standard (monthly geometric mean, from a minimum of five examinations, not to exceed 200 cells/100mL).



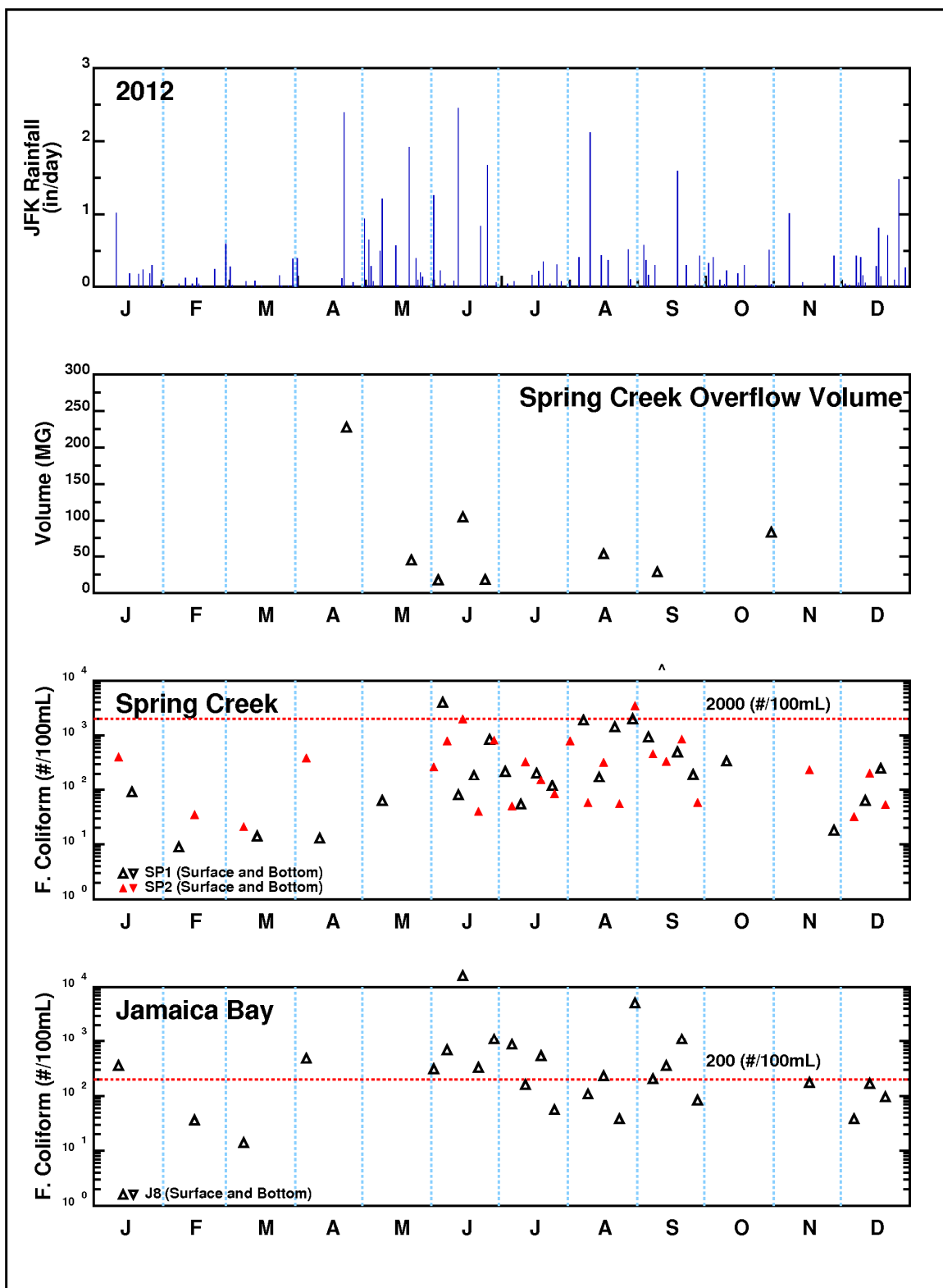
**Figure 2-1.Spring Creek CSO Retention Facility
Location of Facility and Water-Quality Monitoring Stations**

As shown on Figure 2-4, measured enterococci levels at station SP1 were generally greater than those at stations SP2 and J8. At station J8, three discrete observed values were above 35 cells/100mL (the EPA criterion is a rolling 30-day geometric mean of ≤ 35 cells/100mL).

Figure 2-5 presents TSS measurements. TSS concentrations were more variable in Spring Creek (seven observed values at SP1 were higher than about 25 mg/L) than in or near Jamaica Bay (stations SP2 and J8), where all observed values were less than about 25 mg/L.



**Figure 2-2.Spring Creek CSO Retention Facility
 Ambient Water-Quality Monitoring – Dissolved Oxygen, 2012**



**Figure 2-3. Spring Creek CSO Retention Facility
 Ambient Water-Quality Monitoring – Fecal Coliform Bacteria, 2012**

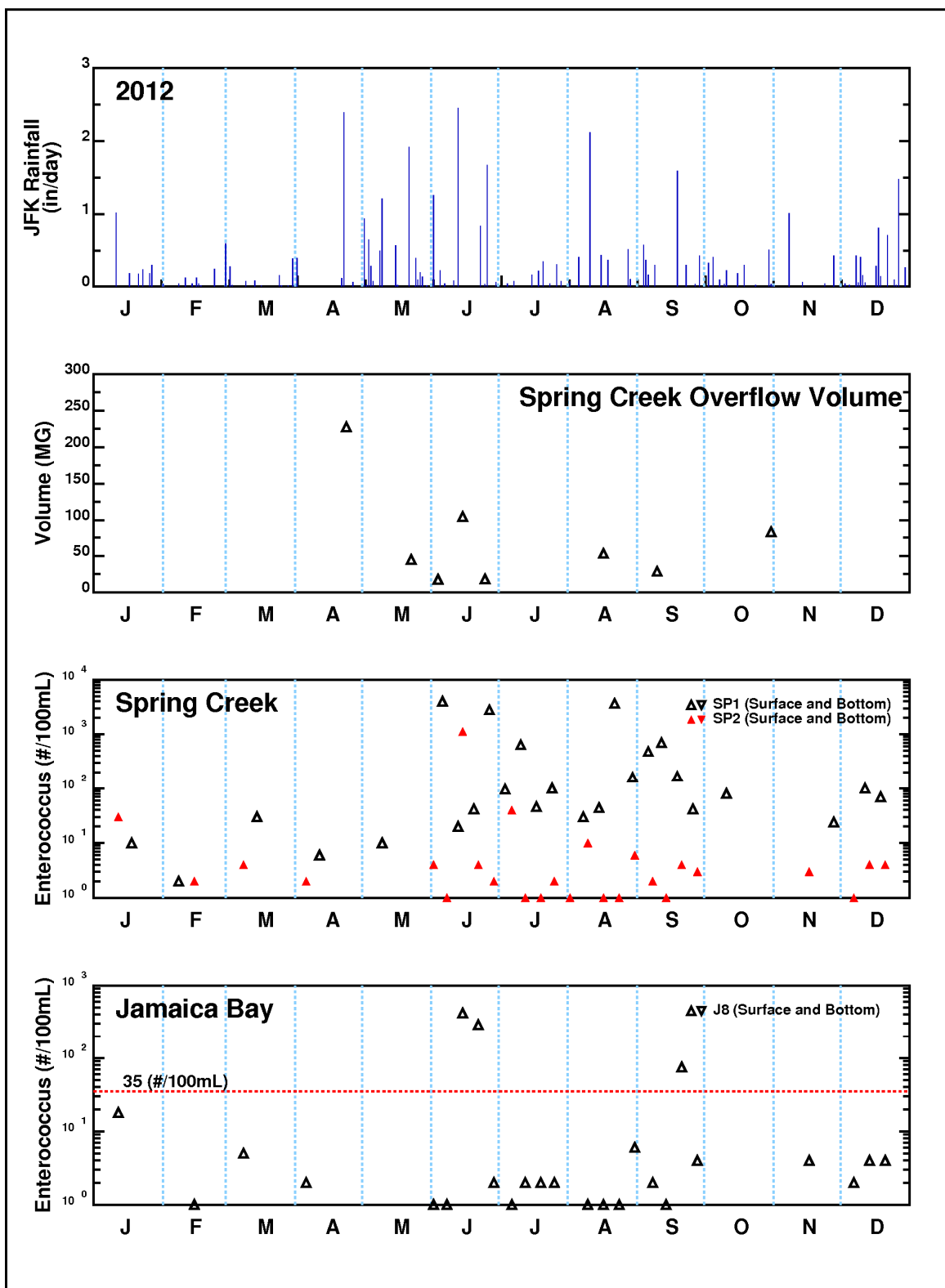
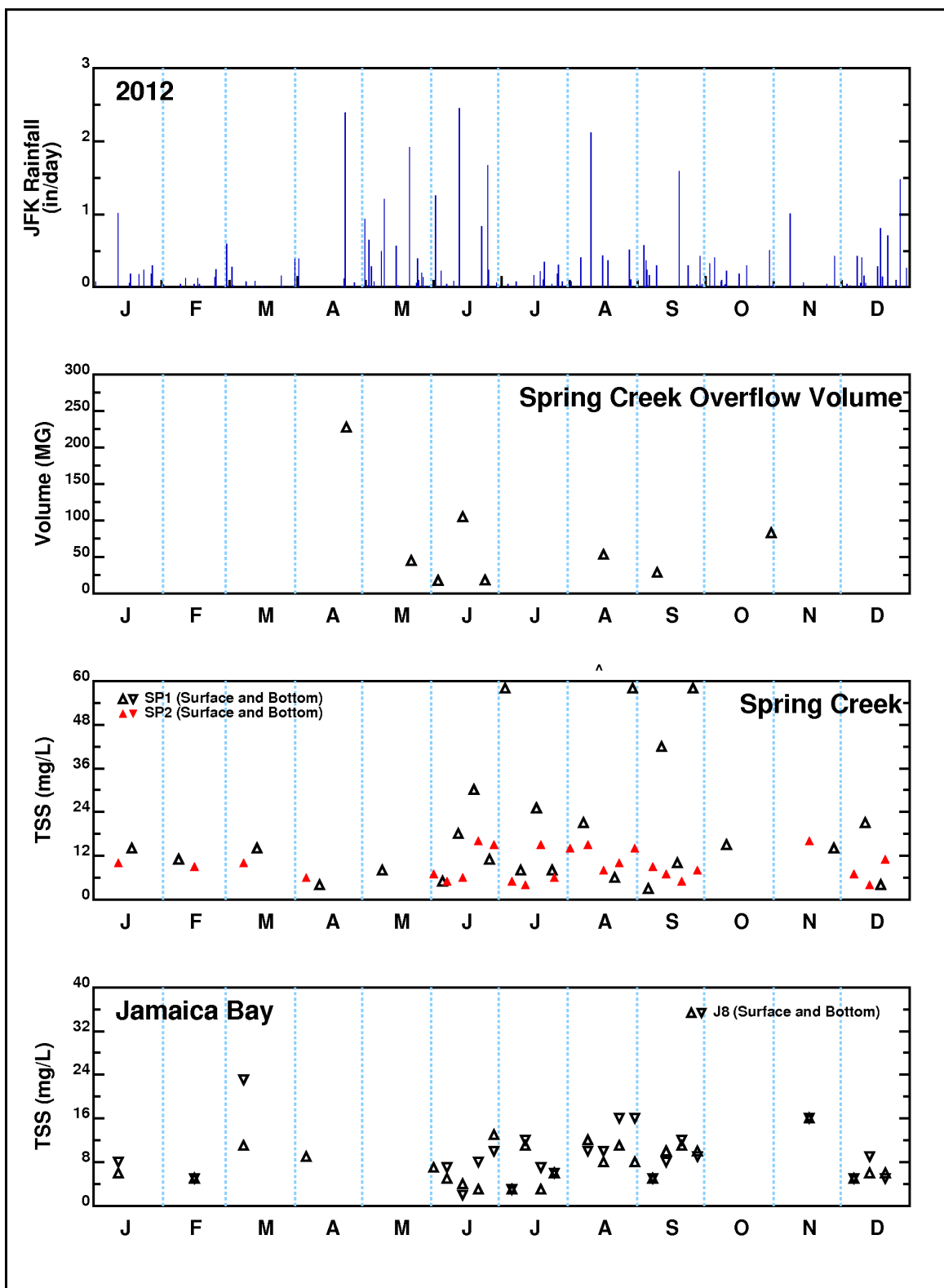


Figure 2-4. Spring Creek CSO Retention Facility
 Ambient Water-Quality Monitoring – Enterococci Bacteria, 2012



**Figure 2-5. Spring Creek CSO Retention Facility
 Ambient Water-Quality Monitoring – TSS, 2012**

2.1.2 Ambient Water Quality Modeling – Spring Creek

An analysis was performed to investigate the impact of the Spring Creek CSO Retention Facility on receiving-water pathogens and DO. This modeling analysis was performed using the Jamaica Eutrophication Model – Larval Transport¹ (JEM-LT) that HDR/HydroQual developed in 2010 as a refinement to the Jamaica Eutrophication Model² (JEM). The JEM-LT computational domain includes Spring Creek as well as all of Jamaica Bay and provides a high level of spatial resolution for water-quality simulations. The model is three-dimensional with 10 vertical layers, and includes a hydrodynamic component (ECOM) to calculate tidal elevations and velocities. The information from the hydrodynamic model serves as input to the water-quality model (RCA). RCA tracks the fate of pathogen concentrations using first-order decay kinetics, and computes DO concentrations based on complex eutrophication kinetics. For DO and pathogens, RCA was calibrated to data collected in 1995 and 1996 during DEP’s Jamaica Bay Eutrophication Study. For salinity and temperature, ECOM was verified using data collected in 2012. The current analysis focuses on the Spring Creek portion of the model domain. As additional monitoring data is collected as part of the PCM program, the modeling analysis can be refined to more accurately explain observed trends and predict response to varying conditions.

The InfoWorks sewer-system models for the Jamaica and 26th Ward WWTP service areas provided discharged quantities to the receiving waters. All InfoWorks model runs were performed using 2012 rainfall and tidal conditions as input, and pollutant loads were determined through assignment of typical sanitary and stormwater concentrations to those components of the discharges. The water-quality model results (concentrations of pathogens and DO) were then compared to the measurements collected in 2012. A complete set of model/data comparisons is shown in Appendix B (pathogens) and Appendix C (DO). The models provide a useful tool for characterizing impact differences in the receiving water for different discharge scenarios (i.e., “with-tank” and “without-tank” impacts). Section 2.1.3 presents a discussion of that analysis.

2.1.3 Impact Analysis—Spring Creek CSO Retention Facility

To analyze the impact of the Spring Creek CSO Retention Facility on water quality in the receiving water, the InfoWorks sewer-system model and the JEM-LT (ECOM/RCA) water-quality model were used to simulate a hypothetical “without-tank” scenario. In the “without-tank” scenario, all combined sewage overflowing the two regulators tributary to Spring Creek is

¹ Lodge, J., J.J. Fitzpatrick, and J. Levinton, 2012. “Defining Restoration Objectives and Design Criteria for Self-Sustaining Oyster Reefs in Jamaica Bay,” prepared for the National Fish & Wildlife Foundation by the Hudson River Foundation, HDR/HydroQual, and SUNY Stony Brook. Project Number 2005-0333-015.

² “A Water Quality Model for Jamaica Bay: Calibration of the Jamaica Bay Eutrophication Model (JEM), Final Report,” prepared by HydroQual, Inc. under subcontract to O’Brien & Gere Engineers for NYCDEP, June 2002.

allowed to discharge to the receiving water as if these regulators overflowed *directly* to the water body (rather than via the tank). Comparing results of the “without-tank” condition to results of the existing “with-tank” condition provides the information to evaluate the impacts of the facility. This section summarizes the impacts of the tank on the concentrations of pathogens and DO in the receiving water. Hydraulic impacts of the tank are summarized in Section 3.

Impacts on Pathogen Indicators

Calculated monthly geometric-mean concentrations for fecal coliform bacteria, total coliform bacteria, and enterococci bacteria for both the “with-tank” and “without-tank” scenarios are shown at three locations in the receiving water (SP1, SP2, and J8) in Appendix D. As an illustration, Table 2-1 presents the results at the two post-construction monitoring locations in Spring Creek (stations SP1 and SP2) and in nearby Jamaica Bay (station J8).

As shown in Table 2-1, model calculations indicate that the Spring Creek facility reduces fecal-coliform concentrations, with monthly geometric mean (MGM) concentration reductions of up to 62 percent at station SP1, up to 31 percent at station SP2, and up to 17 percent at station J8. Table 2-2 expresses these reductions in terms of monthly attainment of the fecal coliform monthly standards (Class I standard within Spring Creek of $\leq 2,000$ cells/100mL, and Class SB standard in Jamaica Bay of ≤ 200 cells/100mL, both as monthly geometric means). As shown in Table 2-2, model simulations for calendar year 2012 conditions show that applicable standards are expected to be met 100 percent of the time for both the “with-tank” and “without-tank” conditions.

**Table 2-1. Model-Calculated Impact of Spring Creek CSO Retention Facility
on Monthly Geometric Mean (MGM) Fecal Coliform Concentrations, 2012**

Month	Model-Calculated Fecal Coliform (MGM ⁽¹⁾ , cells/100 mL)			Model-Calculated Fecal Coliform (MGM, cells/100 mL)			Model-Calculated Fecal Coliform (MGM, cells/100 mL)		
	Station SP1			Station SP2			Station J8		
	With Tank	Without Tank	Percent Reduction (2)	With Tank	Without Tank	Percent Reduction (2)	With Tank	Without Tank	Percent Reduction (2)
Jan	47	59	20	15	15	0	13	13	0
Feb	14	18	22	4	4	0	4	4	0
Mar	13	16	19	5	5	0	4	4	0
Apr	16	18	11	7	7	0	6	6	0
May	94	245	62	34	49	31	28	32	13
Jun	53	100	47	15	21	29	11	13	15
Jul	5	6	17	3	3	0	3	3	0
Aug	17	19	11	7	8	13	5	6	17
Sep	30	36	17	9	10	10	8	8	0
Oct	23	27	15	7	7	0	6	7	1
Nov	11	15	27	5	5	0	4	4	0
Dec	133	255	48	33	39	15	30	32	6
Notes:									
(1) MGM is monthly geometric mean									
(2) Percent reduction in concentrations based on change from “without-tank” to “with-tank” condition.									

**Table 2-2. Model-Calculated Impact of Spring Creek CSO Retention Facility
on Attainment of Fecal Coliform Monthly Standards, 2012**

Location	Model-Calculated Percent Attainment of Fecal Coliform Monthly Standard	
	With Tank	Without Tank
SP1 ⁽¹⁾	100	100
SP2 ⁽¹⁾	100	100
J82 ⁽²⁾	100	100
Notes:		
(1) Applicable Class I standard: fecal coliform monthly geometric mean \leq 2,000 cells/100mL		
(2) Applicable Class SB standard: fecal coliform monthly geometric mean \leq 200 cells/100mL		

Impacts on Dissolved Oxygen

Tables 2-3 through 2-5 provide statistics for the model-calculated ambient DO at stations SP1, SP2 and J8. These statistics include average monthly DO concentration, minimum monthly DO concentration, and the percent of time during each month that the applicable standards are attained at these locations. Model results are summarized for both the “with-tank” and the “without-tank” conditions. For stations SP1 and SP2, the applicable Class I standard is never less than 4.0 mg/L and the tables show the percentage of hours that DO concentration is at least 4.0 mg/L. For station J8, the applicable Class SB standard includes an acute criterion of never-less-than 3.0 mg/L and a chronic criterion expressed as a formulaic limit on the number of hours less than 4.8 mg/L; Table 2-5 presents the percentage of days each month attaining an average daily DO of 4.8 mg/L or higher, since the exposure-duration curve in the NYS standards requires a 66-day interval for analysis, which does not fit neatly into monthly comparisons. It is likely that attainment with the standard would be greater than shown in Table 2-5 because excursions below 4.8 mg/L are allowable, but not accounted for in this analysis.

At station SP1 and SP2, the model-calculated DO concentrations consistently meet water-quality standards for both the “with-tank” and “without-tank” scenarios, except during August, when the combined impact of large storm events and warm temperatures result in calculated excursions below 4.0 mg/L. Model calculations show that the tank marginally increases the DO concentrations (minimum DO improvements of up to 0.3 mg/L at SP1 and about 0.2 mg/L at SP2) and marginally increased the time that DO concentrations remain at or above 4.0 mg/L (by up to 3 percentage points at SP2, in August).

At station J8, the model-calculated impact of the tank was less pronounced, with typical increases of average monthly and monthly minimum DO concentrations of about 0.1 mg/L).

Table 2-3. Model-Calculated Impact of Spring Creek CSO Retention Facility on Monthly Dissolved Oxygen, Station SP1, 2012

Month	Model-Calculated Monthly Average ⁽¹⁾ DO (mg/L)		Model-Calculated Monthly Minimum ⁽¹⁾ DO (mg/L)		Model-Calculated Percent of Time ⁽²⁾ DO ≥ 4.0 mg/L ⁽³⁾	
	With Tank	Without Tank	With Tank	Without Tank	With Tank	Without Tank
Jan	11.6	11.5	10.7	10.6	100	100
Feb	11.1	11.0	9.9	9.7	100	100
Mar	9.7	9.6	7.8	7.6	100	100
Apr	8.8	8.7	6.0	5.9	100	100
May	7.3	7.2	3.6	3.3	100	100
Jun	6.3	6.1	4.1	3.9	100	100
Jul	5.5	5.4	4.0	3.8	100	100
Aug	5.4	5.3	2.1	1.8	92.7	91.5
Sep	6.8	6.7	4.6	4.2	100	100
Oct	8.4	8.3	6.4	6.2	100	100
Nov	10.4	10.4	8.7	8.7	100	100
Dec	10.9	10.9	9.7	9.7	100	100
Notes: (1) Based on 5-minute calculation time step (2) Based on hourly calculated values (3) Applicable Class I water-quality standard						

Table 2-4. Model-Calculated Impact of Spring Creek CSO Retention Facility on Monthly Dissolved Oxygen, Station SP2, 2012

Month	Model-Calculated Monthly Average ⁽¹⁾ DO (mg/L)		Model-Calculated Monthly Minimum ⁽¹⁾ DO (mg/L)		Model-Calculated Percent of Time ⁽²⁾ DO ≥ 4.0 mg/L ⁽³⁾	
	With Tank	Without Tank	With Tank	Without Tank	With Tank	Without Tank
Jan	10.9	10.9	10.3	10.3	100	100
Feb	10.5	10.5	9.9	9.8	100	100
Mar	9.6	9.6	8.3	8.2	100	100
Apr	9.1	9.1	7.3	7.2	100	100
May	8.2	8.2	4.5	4.4	100	100
Jun	7.3	7.3	3.6	3.5	100	99.9
Jul	6.5	6.4	2.6	2.4	97.2	96.2
Aug	3.9	3.8	1.2	1.1	49.6	47.5
Sep	6.0	6.0	2.4	2.2	96.1	94.7
Oct	7.9	7.8	5.8	5.6	100	100
Nov	9.6	9.6	8.1	8.1	100	100
Dec	10.3	10.3	9.5	9.5	100	100
Notes: (1) Based on 5-minute calculation time step (2) Based on hourly calculated values (3) Applicable Class I water-quality standard						

**Table 2-5. Model-Calculated Impact of Spring Creek CSO Retention Facility
on Monthly Dissolved Oxygen, Station J8, 2012**

Month	Model-Calculated Monthly Average ⁽¹⁾ DO (mg/L)		Model-Calculated Monthly Minimum ⁽¹⁾ DO (mg/L)		Model-Calculated Percent of Time DO \geq 3.0 mg/L ⁽²⁾		Model-Calculated Percent of Time DO \geq 4.8 mg/L ⁽³⁾	
	With Tank	Without Tank	With Tank	Without Tank	With Tank	Without Tank	With Tank	Without Tank
Jan	10.9	10.9	10.4	10.4	100	100	100	100
Feb	10.5	10.5	10.1	10.1	100	100	100	100
Mar	9.7	9.7	8.9	8.8	100	100	100	100
Apr	9.2	9.2	8.4	8.4	100	100	100	100
May	8.6	8.5	6.0	5.8	100	100	100	100
Jun	7.7	7.7	5.2	5.1	100	100	100	100
Jul	7.1	7.0	4.0	3.9	100	100	100	98.9
Aug	4.1	4.1	1.6	1.5	100	93.6	12.9	12.9
Sep	6.2	6.2	3.4	3.3	100	100	90.0	90
Oct	7.9	7.9	6.4	6.3	100	100	100	100
Nov	9.6	9.6	8.2	8.1	100	100	100	100
Dec	10.3	10.3	9.9	9.9	100	100	100	100
Notes: (1) Based on 5-minute calculation time step (2) Based on hourly calculated values, applicable Class SB acute dissolved-oxygen standard (3) Based on daily average calculated values, applicable Class SB chronic dissolved-oxygen standard allows limited excursions below 4.8 mg/L: $DO = 13.0 / (2.8 + 1.84 \exp(-0.1 * t))$								

2.2 WATERS IMPACTED BY THE FLUSHING BAY CSO RETENTION FACILITY

2.2.1 Water Quality Monitoring Results—Flushing Creek/Flushing Bay

Post-construction compliance monitoring for the Flushing Bay CSO Retention Facility consists of sample collection at two locations in Flushing Creek (stations FLC1 and FLC2) and one location in Flushing Bay (station FB1). In addition, DEP's Harbor Survey program samples water quality at two other locations in the affected water body: near the mouth of Flushing Creek (station E15), and in Flushing Bay near the East River (station E6). Figure 2-6 presents a map of these station locations.



**Figure 2-6. Flushing Bay CSO Retention Facility
Location of Facility and Water-Quality Monitoring Stations**

The Flushing Bay monitoring results are tabulated in Appendix E and on Figures 2-7 through 2-10. The results are shown for DO, fecal coliform bacteria, enterococci bacteria, and TSS, respectively. The top panel of each figure shows the daily rainfall for 2012 (at LaGuardia Airport). The second panel presents the reported overflow volumes discharged from the

Flushing Bay CSO Retention facility during the same period. The third panel shows the measured constituent concentrations for the stations in Flushing Creek, and the bottom panel shows the measured constituent concentrations for the stations in Flushing Bay. Applicable NYS water-quality standards (Class I for all locations) are also shown.

On Figure 2-7, the DO-monitoring results for Flushing Creek show excursions below the standard (≥ 4.0 mg/L) from late May through early October. In Flushing Bay, DO values generally attained the standard of ≥ 4.0 mg/L, except during the summer months, when DO concentrations were occasionally below 4.0 mg/L, but generally above 3.0 mg/L.

Figure 2-8 presents the fecal-coliform concentrations measured in Flushing Creek. Discrete values were generally above the geometric-mean standard ($\leq 2,000$ cells/100mL), especially during the summer. In Flushing Bay, eight measurements were near or above 2,000 cells/100mL, but the vast majority of measurements were below the geometric-mean standard.

As shown on Figure 2-9, enterococci levels in Flushing Creek are generally elevated with many values above 100 cells/100mL and some values above 1,000 cells/100mL. In Flushing Bay, most samples were less than 35 cells/100mL, but there were seven measurements at or greater than 100 cells/100mL.

Figure 2-10 presents the results of TSS sampling. Measured TSS concentrations were generally below 20 mg/L in both Flushing Creek and Flushing Bay. Higher TSS concentrations do not appear to be well correlated to rainfall.

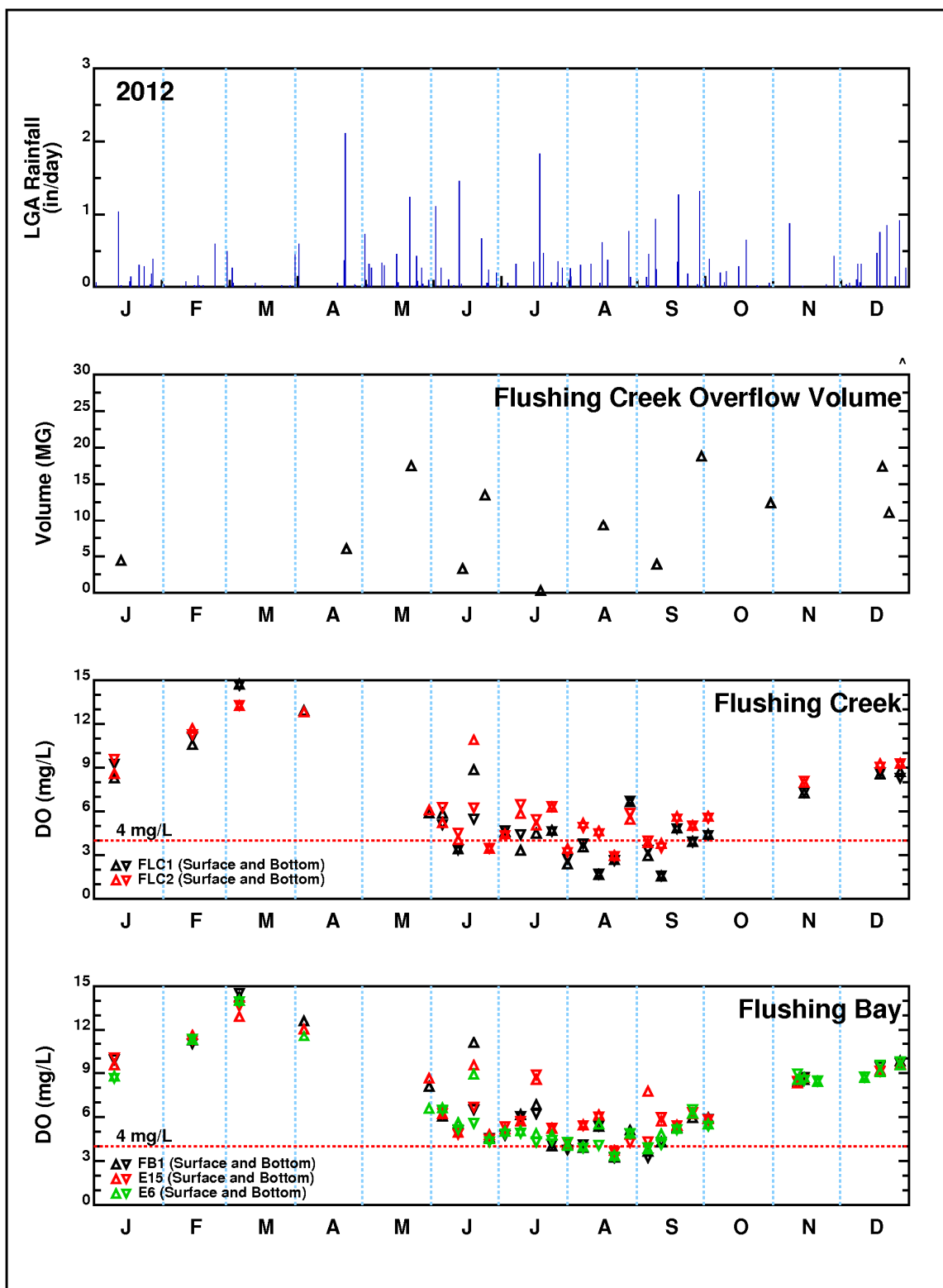
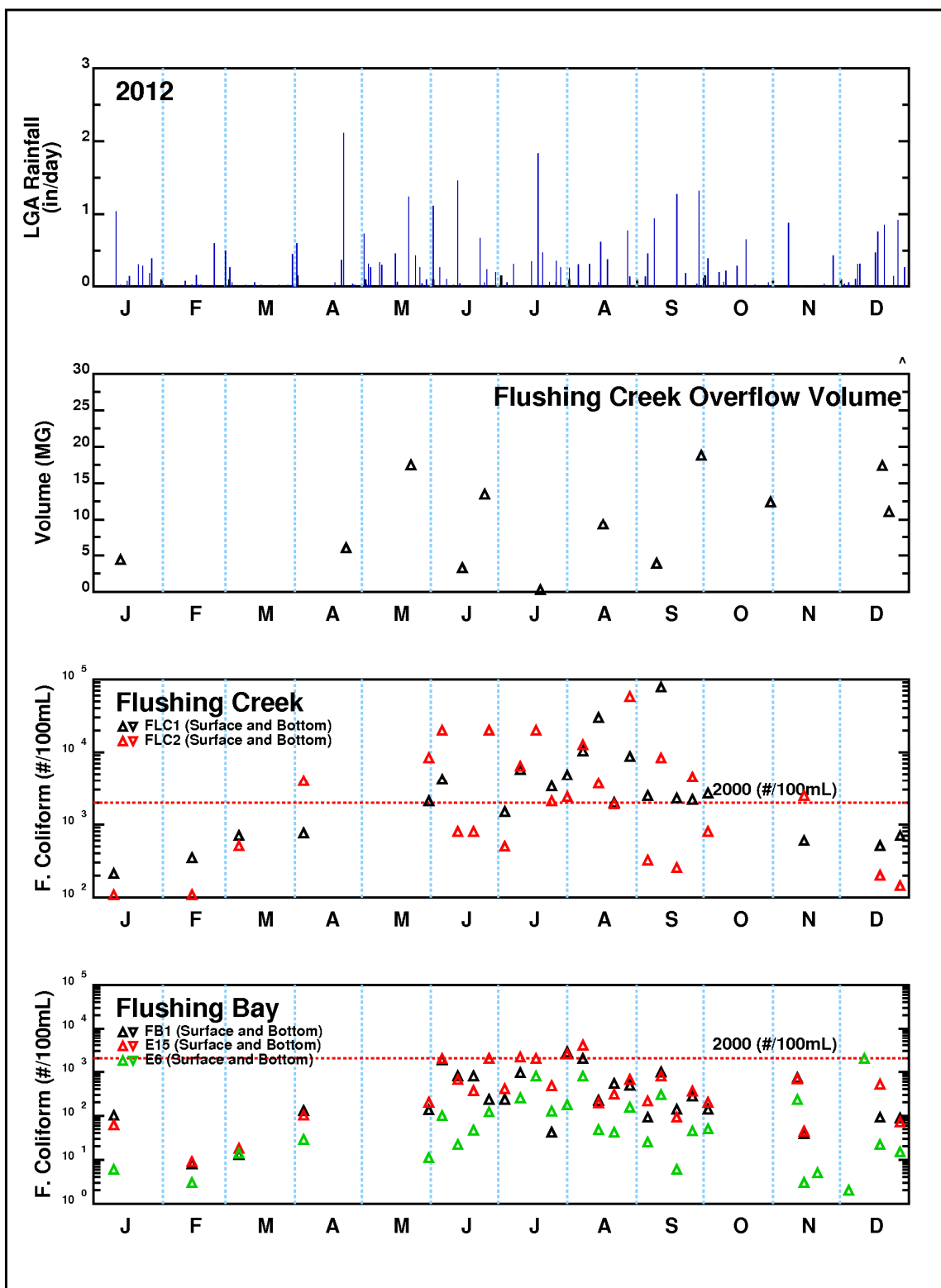
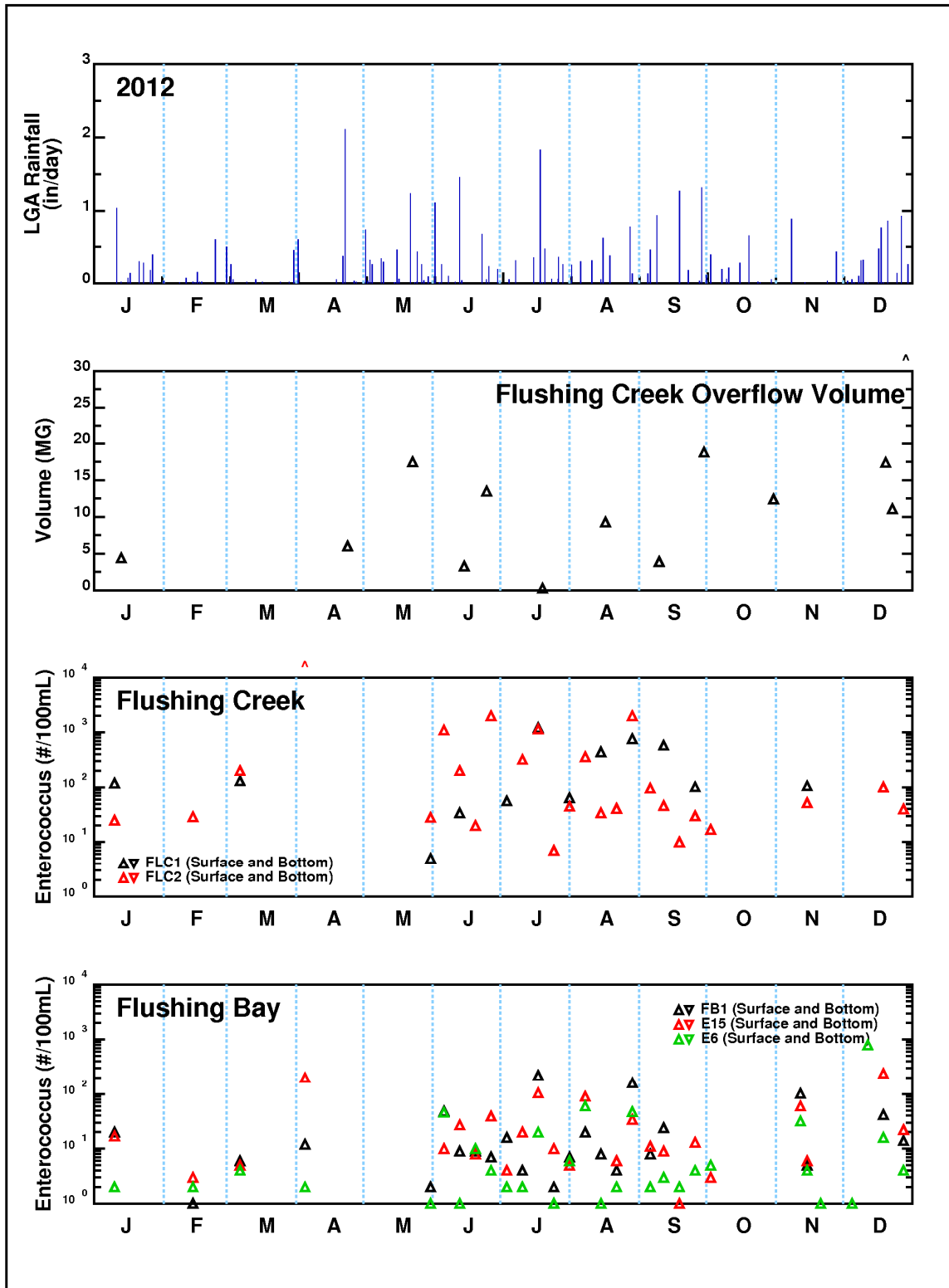


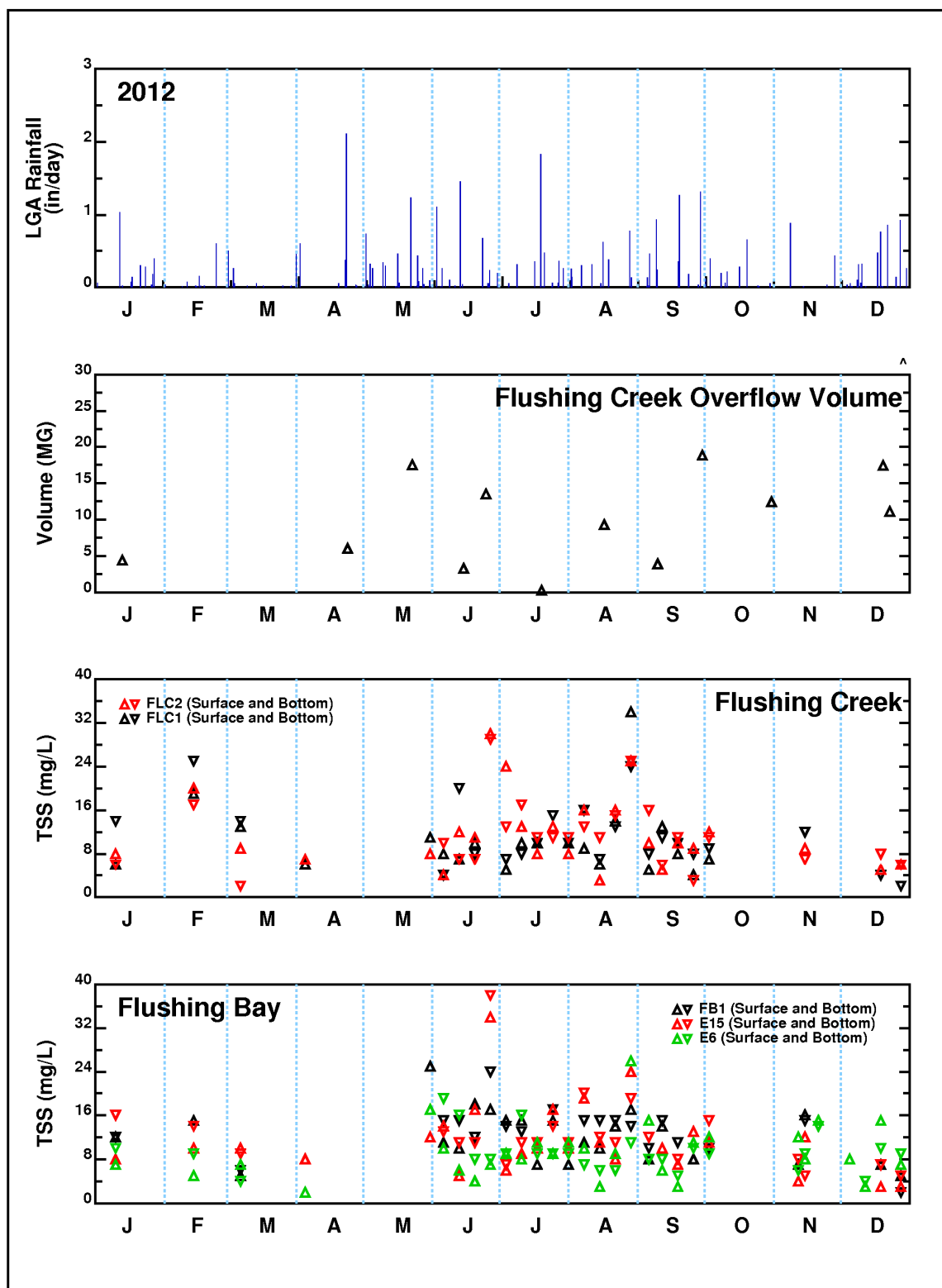
Figure 2-7. Flushing Bay CSO Retention Facility
 Ambient Water-Quality Monitoring – Dissolved Oxygen, 2012



**Figure 2-8. Flushing Bay CSO Retention Facility
 Ambient Water-Quality Monitoring – Fecal Coliform Bacteria, 2012**



**Figure 2-9. Flushing Bay CSO Retention Facility
 Ambient Water-Quality Monitoring – Enterococci Bacteria, 2012**



**Figure 2-10. Flushing Bay CSO Retention Facility
 Ambient Water-Quality Monitoring –TSS, 2012**

2.2.2 Ambient Water Quality Modeling—Flushing Creek/Flushing Bay

An analysis was performed to investigate the impact of the Flushing Bay CSO Retention Facility on receiving-water pathogens and DO. This modeling analysis was performed using the East River Tributaries Model (ERTM) developed as part of the Long Term Control Plan (*Receiving Water Quality Modeling Report, Volume 3, East River Tributaries Model (ERTM)*). The ERTM computational domain includes the open waters of the lower and upper East River from the Battery to Throgs Neck and into western Long Island Sound, and provides a high level of spatial resolution for simulating water quality in the East River Tributaries of Flushing Creek, Flushing Bay, Westchester Creek, Hutchinson River, and Alley Creek. The model is three-dimensional with ten vertical layers and includes a hydrodynamic component (ECOM) to calculate tidal elevations and velocities. The information from ECOM serves as input to the water-quality model (RCA). RCA tracks the fate of pathogen concentrations using first-order decay kinetics, and computes DO concentrations based on complex eutrophication kinetics. For DO, ERTM was calibrated in Flushing Bay and Creek based on data collected in water year 1999-2000. For pathogens, ERTM was calibrated using data collected DEP's Harbor Survey water-quality sampling program, DEP's Sentinel Monitoring Program, and an Interstate Environmental Commission (IEC) monitoring program from 2001 through 2003. As additional monitoring data is collected as part of the PCM program, the modeling analysis can be refined to more accurately explain observed trends and predict response to varying conditions.

Receiving-water model calculations were performed using pollutant-loading inputs generated using results of the InfoWorks and RAINMAN collection-system models for the areas tributary to Flushing Creek and Flushing Bay from the Tallman Island and Bowery Bay service area models, respectively. All model runs were performed using 2012 rainfall and tidal conditions as input (see Section 3). The model results for calculated concentrations of pathogens and DO were then compared to the measurements collected in 2012. A complete set of model/data comparisons is shown in Appendix F (pathogens) and Appendix G (DO). Overall, the 2012 model/data comparisons are favorable in that the modeled results generally track the trends in the data. The model is a useful tool to analyze the impacts of various factors on water quality. As described below, the model can be used to assess the impact of the Flushing Bay CSO Retention Facility on water quality in the receiving waters.

2.2.3 Impact Analysis—Flushing Bay CSO Retention Facility

To analyze the impact of the Flushing Bay CSO Retention Facility on water quality in the receiving water, the InfoWorks collection-system model and the ERTM (RCA) water-quality model described above were used to simulate a hypothetical “without-tank” scenario. In the “without-tank” scenario, the Flushing Bay facility (including influent screens and storage volume) is replaced with a simple conduit leading to outfall TI-010. The existing weirs and bypasses (such as bulkhead gate 5) remain in the model. Comparison of the results of the “without-tank” condition to results of the existing “with-tank” condition provide the information to evaluate the impacts of the facility. This section summarizes the impacts of the tank on the concentrations of pathogens and DO in the receiving water. Hydraulic impacts of the tank are summarized in Section 3.

Impacts on Pathogen Indicators

Calculated monthly geometric-mean concentrations for fecal coliform bacteria, total coliform bacteria, and enterococci bacteria - for both the “with-tank” and “without-tank” scenarios - are shown at seven stations (head end, discharge location, FLC1, FLC2, E15, FB1, and E6) are shown in Appendix H. Table 2-6 presents the results for calculated fecal coliform concentration at the tank-discharge location and at the two post-construction monitoring locations within Flushing Creek. As shown, the modeling analysis indicates that the Flushing Bay tank provides significant reduction in fecal coliform concentrations in the receiving water. Reductions in the MGM (monthly geometric mean) concentrations range from 41 to 81 percent at the discharge location to 25 to 68 percent at FLC2.

Table 2-7 expresses the impact of the tank in terms of monthly attainment of the fecal coliform monthly standard of $\leq 2,000$ cells/100mL. As shown, the tank improves attainment at the discharge location by 17 percent, and with calculated attainment at stations FLC1 and FLC2 already at 100 percent without the tank, the model calculations indicate that the tank further reduces the fecal coliform concentrations as described above and shown in Table 2-6.

Table 2-6. Model-Calculated Impact of Flushing Bay CSO Retention Facility on Fecal Coliform Monthly Geometric Mean (MGM) Concentrations, 2012

Month	Model-Calculated Fecal Coliform (MGM, cells/100 mL)			Model-Calculated Fecal Coliform (MGM, cells/100 mL)			Model-Calculated Fecal Coliform (MGM, cells/100 mL)		
	Tank Discharge Location			Station FLC1			Station FLC2		
	With Tank	Without Tank	Percent Reduction ⁽¹⁾	With Tank	Without Tank	Percent Reduction ⁽¹⁾	With Tank	Without Tank	Percent Reduction ⁽¹⁾
Jan	732	1,233	41	568	882	36	342	459	25
Feb	267	703	62	173	417	59	92	186	51
Mar	191	557	66	111	270	59	75	133	44
Apr	422	906	53	272	510	47	160	262	39
May	718	3,245	78	686	2,778	70	613	1,353	55
Jun	443	1,752	75	338	1,083	69	256	568	55
Jul	306	1,535	80	219	899	76	141	442	68
Aug	281	1,465	81	210	985	79	154	483	68
Sep	508	1,512	66	366	849	57	219	416	47
Oct	347	1,189	71	259	667	61	193	358	46
Nov	322	661	51	186	301	38	98	140	30
Dec	1,784	4,815	63	1,605	3,128	49	1,224	1,880	35

⁽¹⁾ Percent reduction in concentrations based on change from “without-tank” to “with-tank” condition.

Table 2-7. Model-Calculated Impact of Flushing Bay CSO Retention Facility on Attainment of Fecal Coliform Monthly Standards - Flushing Creek, 2012

Location in Flushing Creek	Model-Calculated Percent Attainment of Fecal Coliform Monthly Standard ⁽¹⁾	
	With Tank	Without Tank
At Tank Discharge (TI-010)	100	83
Station FLC1	100	100
Station FLC2	100	100

⁽¹⁾ Applicable Class I standard: fecal coliform monthly geometric mean $\leq 2,000$ cells/100mL

Impacts on Dissolved Oxygen

Tables 2-8 and 2-9 show statistics for model-calculated water quality at the two Flushing Creek sampling locations (stations FLC1 and FLC2). The statistics include model-calculated average monthly DO concentrations, minimum monthly DO concentrations, and the percent of time (hours) during each month that the DO concentrations attain the applicable Class I standard of ≥ 4.0 mg/L. Results are summarized for both the “with-tank” and “without-tank” scenarios.

Table 2-8 summarizes the model-calculated impact of the Flushing Bay tank at station FLC1. Model-calculated increases in average monthly DO concentration range from 0.3 mg/L to 1.0 mg/L. Model-calculated increases in minimum DO concentration range from 0.4 mg/L to 1.5 mg/L. Model-calculated monthly increases in attainment of DO standards are significant, particularly in the warmer months. For example, model-calculated attainment of ≥ 4.0 mg/L improved to 51 percent from 2 percent of hours in August; model-calculated attainment improved to 76 percent from 18 percent in September.

Table 2-9 summarizes the model-calculated impact of the Flushing Bay tank at station FLC2. Model-calculated increases in average monthly DO range from 0.2 mg/L to 0.9 mg/L; increases in minimum DO range from 0.3 to 0.9 mg/L; and monthly attainment of at least 4.0 mg/L increased in four months (to 100 percent in June and September, to 87 percent from 59 percent in July, and to 98 percent from 47 percent in August).

Table 2-8. Model-Calculated Impact of Flushing Bay CSO Retention Facility on Monthly Dissolved Oxygen, Station FLC1, 2012

Month	Model-Calculated Monthly Average ⁽¹⁾ DO (mg/L)		Model-Calculated Monthly Minimum ⁽²⁾ DO (mg/L)		Model-Calculated Percent of Time ⁽³⁾ DO \geq 4.0 mg/L ⁽³⁾	
	With Tank	Without Tank	With Tank	Without Tank	With Tank	Without Tank
Jan	9.7	9.3	8.7	8.3	100	100
Feb	10.9	10.4	9.6	8.8	100	100
Mar	10.6	10.3	9.0	7.9	100	100
Apr	8.4	7.9	6.1	5.4	100	100
May	6.6	6.1	4.6	3.1	100	98
Jun	4.2	3.3	1.4	0.9	72	15
Jul	4.2	3.3	1.1	0.5	56	28
Aug	3.9	2.9	1.4	0.7	51	2
Sep	4.3	3.3	1.8	0.7	76	18
Oct	6.0	5.1	3.6	2.3	99	91
Nov	7.5	6.7	6.2	5.0	100	100
Dec	8.6	7.8	7.6	6.2	100	100
Notes: (1) Based on 5-minute calculation time step (2) Based on hourly calculated values (3) Applicable Class I water-quality standard						

Table 2-9. Model-Calculated Impact of Flushing Bay CSO Retention Facility On Monthly Dissolved Oxygen, Station FLC2, 2012

Month	Model-Calculated Monthly Average ⁽¹⁾ DO (mg/L)		Model-Calculated Monthly Minimum ⁽²⁾ DO (mg/L)		Model-Calculated Percent of Time ⁽³⁾ DO \geq 4.0 mg/L ⁽³⁾	
	With Tank	Without Tank	With Tank	Without Tank	With Tank	Without Tank
Jan	9.9	9.7	9.2	8.6	100	100
Feb	11.2	10.9	10.4	9.9	100	100
Mar	10.9	10.7	9.8	9.5	100	100
Apr	9.0	8.8	7.6	7.2	100	100
May	7.3	7.0	5.7	5.3	100	100
Jun	5.2	4.6	4.1	3.4	100	96
Jul	5.1	4.4	3.4	2.7	87	59
Aug	4.9	4.0	3.6	2.8	98	47
Sep	5.2	4.5	4.1	3.2	100	90
Oct	6.6	6.0	4.8	4.1	100	100
Nov	7.9	7.4	6.8	6.2	100	100
Dec	8.9	8.5	8.6	8.0	100	100
Notes: (1) Based on 5-minute calculation time step (2) Based on hourly calculated values (3) Applicable Class I water-quality standard						

2.3 WATERS IMPACTED BY THE ALLEY CREEK CSO RETENTION FACILITY

2.3.1 Water Quality Monitoring Results—Alley Creek/Little Neck Bay

Post-construction compliance monitoring for the Alley Creek CSO Retention Facility consists of sample collection at one location in Alley Creek (station AC1) and one location in Little Neck Bay (station LN1). Through its CSO LTCP project, DEP also collected water-quality samples during November and December 2012 at two other locations in the affected water body: near the mouth of Alley Creek (stations OW0 and OW1), and in Little Neck Bay near station LN1 (station OW2). Figure 2-11 presents a map of these station locations.



**Figure 2-11. Alley Creek CSO Retention Facility
Location of Facility and Water-Quality Monitoring Stations**

The Alley Creek/Little Neck Bay monitoring results are tabulated in Appendix I and on Figures 2-12 through 2-15. The results are shown for DO, fecal coliform bacteria, enterococci bacteria, and TSS, respectively. The top panel of each figure shows the daily rainfall for 2012 (at LaGuardia Airport). The second presents the reported overflow volumes discharged from the

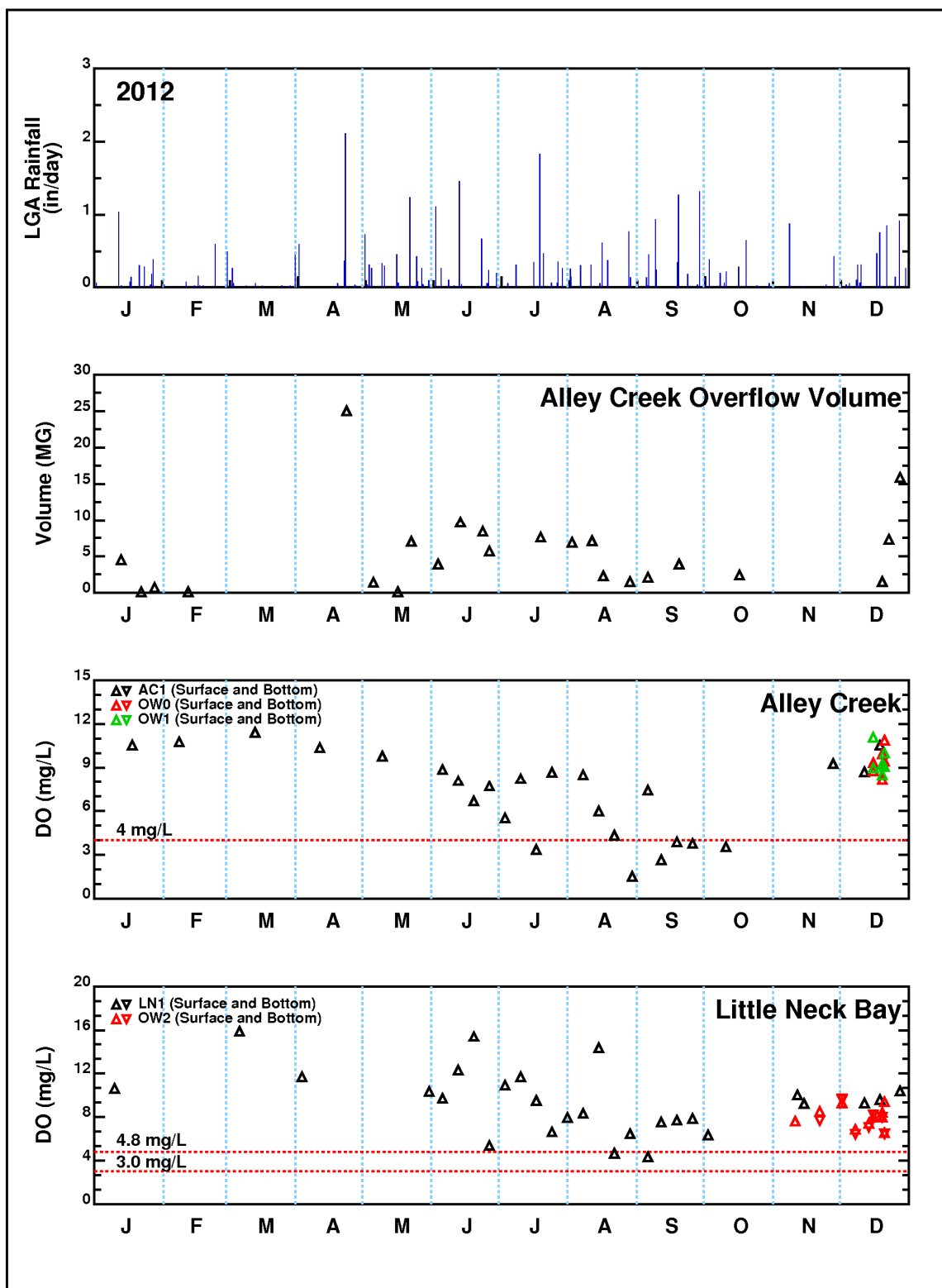
Alley Creek CSO Retention facility during the same period. The third panel shows the measured constituent concentrations for the stations in Alley Creek, and the bottom panel shows the measured constituent concentrations for the stations in Little Neck Bay. Applicable NYS water quality standards (Class I for Alley Creek and Class SB for Little Neck Bay) are also shown.

On Figure 2-12, the DO-monitoring results for Alley Creek show occasional excursions below the standard (≥ 4.0 mg/L) from July through October. In Little Neck Bay, DO values were generally above the chronic standard (≥ 4.8 mg/L), except for one sample in mid-August and another in early September. All DO measurements in Little Neck Bay were above the acute standard of ≥ 3.0 mg/L.

Figure 2-13 presents the fecal coliform concentrations measured in Alley Creek and Little Neck Bay. Discrete values in Alley Creek were often above the geometric-mean standard ($\leq 2,000$ cells/100mL), with the majority of high concentrations occurring during the summer. In Little Neck Bay, most discrete measurements were below the geometric-mean standard of ≤ 200 cells/100mL. The few discrete measurements above 200 cells/100mL occurred during August, November and December.

As shown on Figure 2-14, enterococci levels in Alley Creek are generally elevated, with numerous values above 1,000 cells/100mL and two values above 10,000 cells/100mL. In Little Neck Bay, all samples collected through October were less than 10 cells/100mL, but during November and December, many values were above the EPA criterion of 35 cells/100mL.

Figure 2-15 presents the results of TSS sampling in Alley Creek and Little Neck Bay. TSS concentrations in Alley Creek are quite variable, with two measurements greater than 150 mg/L. In Little Neck Bay, measured TSS concentrations are generally below 25 mg/L, with a few higher values in late August and September.



**Figure 2-12. Alley Creek CSO Retention Facility
 Ambient Water-Quality Monitoring – Dissolved Oxygen, 2012**

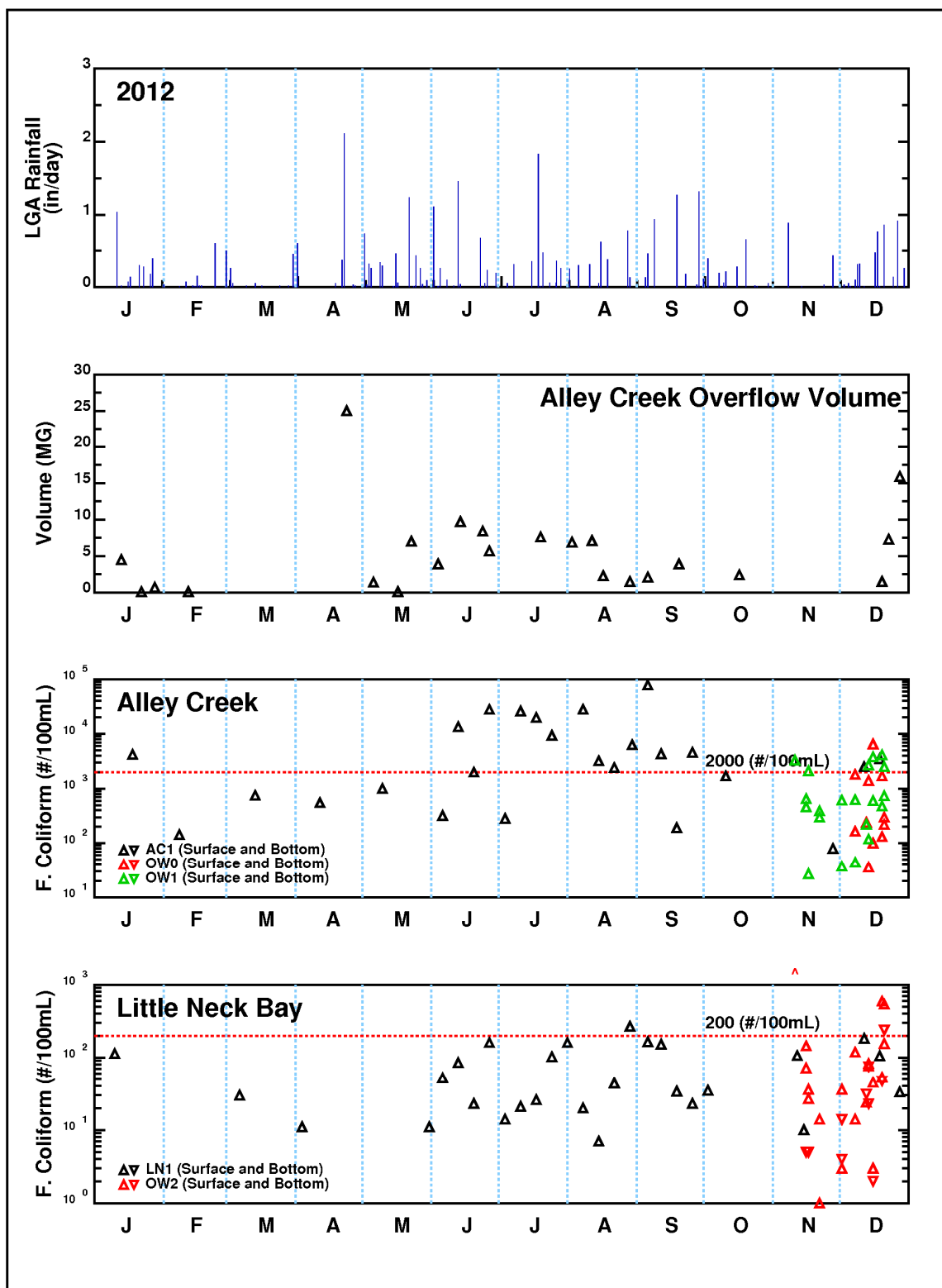
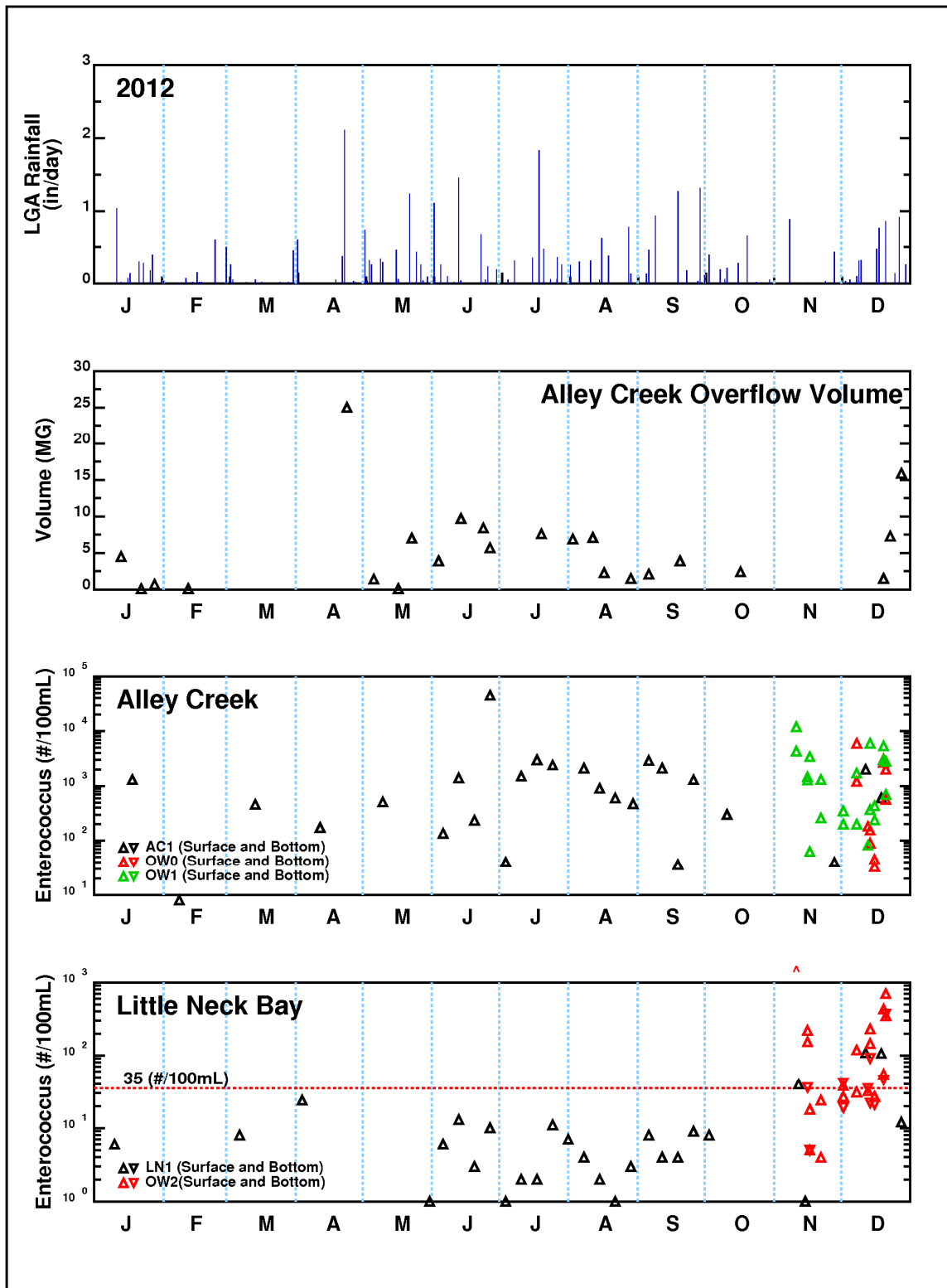
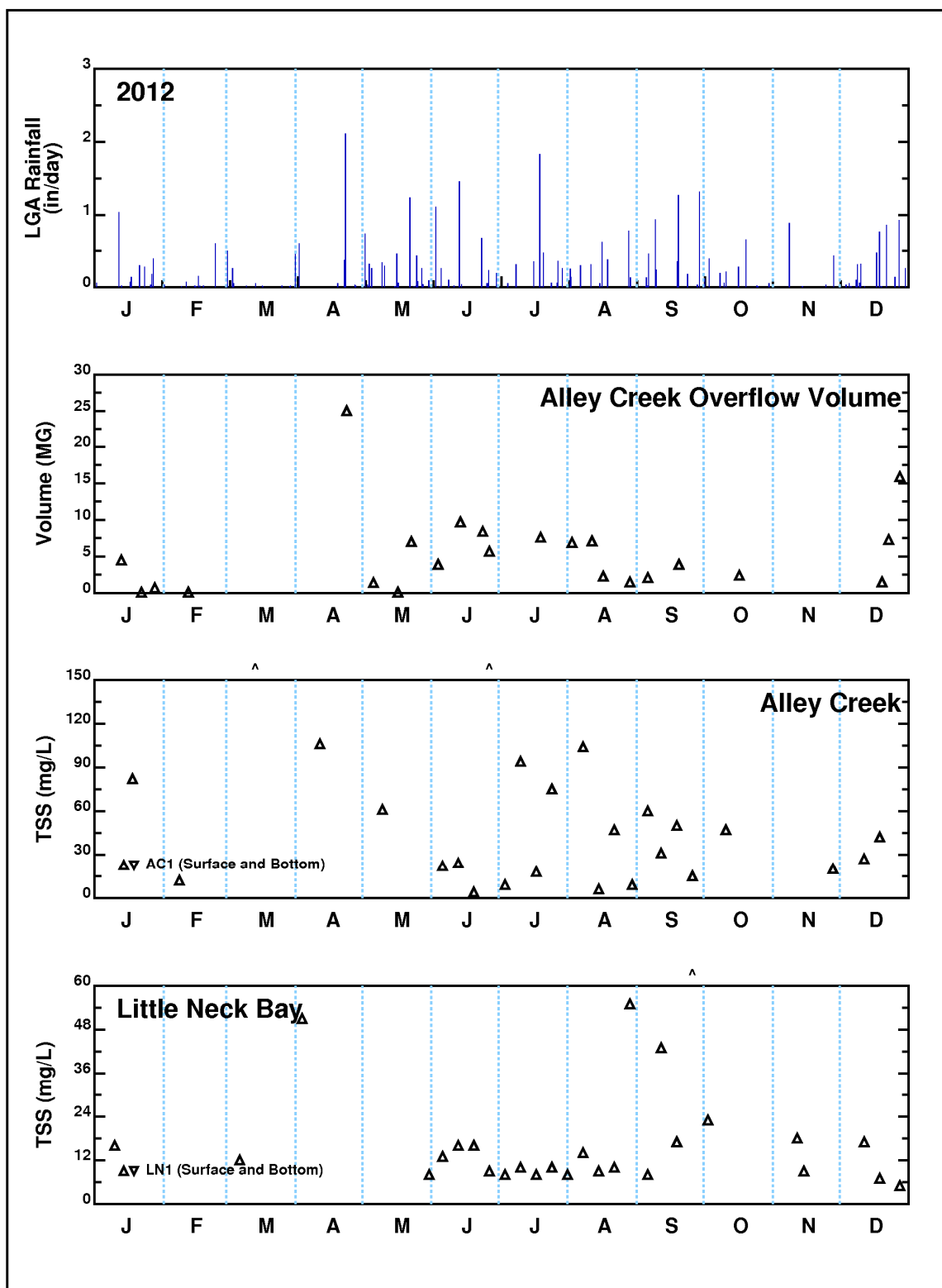


Figure 2-13. Alley Creek CSO Retention Facility
 Ambient Water-Quality Monitoring – Fecal Coliform Bacteria, 2012



**Figure 2-14. Alley Creek CSO Retention Facility
 Ambient Water-Quality Monitoring – Enterococci Bacteria, 2012**



**Figure 2-15. Alley Creek CSO Retention Facility
 Ambient Water-Quality Monitoring – TSS, 2012**

2.3.2 Ambient Water Quality Modeling—Alley Creek/Little Neck Bay

An analysis was performed to investigate the impact of the Alley Creek CSO Retention Facility on receiving-water pathogens and DO. This modeling analysis was performed using the East River Tributaries Model (ERTM) developed as part of the Long Term Control Plan (as described in *Receiving Water Quality Modeling Report, Volume 3, East River Tributaries Model (ERTM)*), and modified for enhanced spatial resolution in Alley Creek and Little Neck Bay as part of ongoing work for the Alley Creek LTCP. The model is three-dimensional with ten vertical layers and includes a hydrodynamic component (ECOM) to calculate tidal elevations and velocities. The information from ECOM serves as input to the water quality model (RCA). RCA tracks the fate of pathogen concentrations using first-order decay kinetics, and computes DO concentrations based on complex eutrophication kinetics. For DO and pathogens, ERTM was further calibrated in Alley Creek and Little Neck Bay based on measured data from 2011 and 2012. As additional monitoring data is collected as part of the PCM program, the modeling analysis can be refined to more accurately explain observed trends and predict response to varying conditions.

Receiving-water model calculations reflect pollutant-loading inputs generated using results of the InfoWorks collection-system model from New York City areas, and from RAINMAN (a simplified hydrologic model) for Nassau County areas. InfoWorks model runs were performed using 2012 rainfall and tidal conditions as input (see Section 3). Given the pollutant loadings, the water-quality model generated the ambient concentrations of pathogens and DO, which were then compared to the measurements collected in 2012. A complete set of model/data comparisons is shown in Appendix J (pathogens) and Appendix K (DO). Overall, the 2012 model/data comparisons are favorable in that the modeled results generally track the trends in the data. The model is a useful tool to analyze the impacts of various factors on water quality. As described below, the model can be used to assess the impact of the Alley Creek CSO Retention Facility on water quality in the receiving waters.

2.3.3 Impact Analysis—Alley Creek CSO Retention Facility

To analyze the impact of the Alley Creek CSO Retention Facility on water quality in the receiving water, the InfoWorks collection-system model and the ERTM (RCA) water-quality model described above were used to simulate a hypothetical “without-tank” scenario. In the “without-tank” scenario, the Alley Creek facility (including influent screens and storage volume) is absent so that Chamber 6 flows directly to TI-008. Comparison of the results of the “without-tank” condition to results of the existing “with-tank” condition provides the information to evaluate the impacts of the facility. This section summarizes the impacts of the tank on the concentrations of pathogens and DO in the receiving water. Hydraulic impacts of the tank are summarized in Section 3.

Impacts on Pathogen Indicators

Calculated monthly geometric-mean concentrations for fecal coliform bacteria, total coliform bacteria, and enterococci bacteria - for both the “with-tank” and “without-tank” scenarios - are shown at stations AC1, LN1, and E11 in Appendix L. Table 2-10 summarizes the results near the discharge location (station AC1) and the other monitoring locations.

Table 2-10. Model-Calculated Impact of Alley Creek CSO Retention Facility on Fecal Coliform Monthly Geometric Mean (MGM) Concentrations, 2012

Month in 2012	Model-Calculated Fecal Coliform (MGM, cells/100 mL)			Model-Calculated Fecal Coliform (MGM, cells/100 mL)			Model-Calculated Fecal Coliform (MGM, cells/100 mL)		
	Station AC1			Station LN1			Station E11		
	With Tank	With- out Tank	Percent Reduction ⁽¹⁾	With Tank	With- out Tank	Percent Reduction ⁽¹⁾	With Tank	With- out Tank	Percent Reduction ⁽¹⁾
Jan	840	875	4	56	59	5	24	26	8
Feb	675	700	4	38	40	5	12	12	0
Mar	555	585	5	31	31	0	13	13	0
Apr	651	687	5	39	41	5	14	15	7
May	803	864	7	63	71	11	37	39	5
Jun	674	737	9	40	43	7	17	17	0
Jul	560	613	9	24	25	4	8	9	11
Aug	570	620	8	26	28	7	10	10	0
Sep	736	788	7	38	40	5	13	14	7
Oct	626	648	3	31	32	3	11	11	0
Nov	662	681	3	33	34	3	10	10	0
Dec	1,273	1,368	7	102	111	8	48	50	4

⁽¹⁾ Percent reduction in concentrations based on change from “without-tank” to “with-tank” condition.

As shown in Table 2-11, the model-calculated fecal coliform MGM values meet the applicable standards in both Alley Creek (Class I, $\leq 2,000$ cells/100mL) and Little Neck Bay (Class SB, ≤ 200 cells/100mL). The Alley Creek tank provides reductions in fecal coliform MGM concentrations of up to 11 percent, as summarized in Table 2-10. Inputs from stormwater and local sources limit the improvement of the calculated MGM, which is dominated by dry-weather conditions.

Table 2-11. Model-Calculated Impact of Alley Creek CSO Retention Facility on Attainment of Fecal Coliform Monthly Standards - Alley Creek, 2012

Location in Alley Creek	Model-Calculated Percent Attainment of Fecal Coliform Monthly Standard ⁽¹⁾	
	With Tank	Without Tank
Station AC1 ⁽¹⁾	100	100
Station LN1 ⁽²⁾	100	100
Station E11 ⁽²⁾	100	100
⁽¹⁾ Applicable Class I fecal coliform monthly standard $\leq 2,000$ cells/100mL. ⁽²⁾ Applicable Class SB fecal coliform monthly standard ≤ 200 cells/100mL.		

Impacts on Dissolved Oxygen

Tables 2-12 through 2-14 show statistics calculated at three Alley Creek sampling locations (stations AC1, LN1, and E11). The statistics include average monthly DO concentration, minimum monthly DO concentration, and the percent of hours during each month that DO concentrations are below the applicable Class I standard of ≥ 4.0 mg/L. Results are summarized for both the “with-tank” and “without-tank” scenarios.

Model calculations indicate that, at station AC1, the tank marginally improves average monthly DO concentrations by as much as 0.6 mg/L, improves minimum DO concentrations by as much as 1.7 mg/L, and improves the percentage of time at or above 4.0 mg/L for six months (June improves to 93 percent attainment from 81 percent attainment).

Tables 2-13 and 2-14 present the model-calculated impact of the Alley Creek tank on DO at stations LN1 and E11 for 2012. Calculated attainment of the acute criterion of never-less-than 3.0 mg/L improved about 10 percent in August at station LN1; no significant change was calculated for this criterion at E11. Attainment of the chronic criterion was not explicitly calculated (due to the incompatibility of monthly expression of the 66-day interval associated with the exposure-duration formulation), so for comparison purposes an average daily DO criterion of 4.8 mg/L was used in Tables 2-13 and 2-14. As shown, calculated attainment of this criterion at LN1 improves by as much as 10 percent (August and September 2012); at E11,

calculated improvements are as much as 3 percent (September 2012). It is likely that attainment with the standard would be greater than shown in Tables 2-13 and 2-14 because excursions below 4.8 mg/L are allowable, but not accounted for in this analysis.

Table 2-12. Model-Calculated Impact of Alley Creek CSO Retention Facility on Monthly Dissolved Oxygen, Station AC1, 2012

Month	Model-Calculated Monthly Average ⁽¹⁾ DO (mg/L)		Model-Calculated Monthly Minimum ⁽¹⁾ DO (mg/L)		Model-Calculated Percent of Time ⁽²⁾ DO ≥ 4.0 mg/L ⁽³⁾	
	With Tank	Without Tank	With Tank	Without Tank	With Tank	Without Tank
Jan	10.8	10.7	7.3	7.0	100	100
Feb	12.2	12.1	7.4	6.4	100	100
Mar	10.6	10.6	6.1	5.9	100	100
Apr	8.3	8.1	4.1	3.7	100	100
May	6.9	6.6	4.2	3.6	100	98
Jun	5.5	5.1	1.2	0.9	93	81
Jul	6.6	6.3	2.3	1.9	98	93
Aug	5.3	4.8	2.4	1.9	84	73
Sep	5.4	4.9	1.1	0.6	87	77
Oct	7.7	7.4	3.3	2.7	100	99
Nov	8.6	8.1	6.8	5.4	100	100
Dec	9.6	9.0	6.6	4.9	100	100
Notes: (1) Based on 5-minute calculation time step (2) Based on hourly calculated values (3) Applicable Class I water-quality standard						

**Table 2-13. Model-Calculated Impact of Alley Creek CSO Retention Facility
on Monthly Dissolved Oxygen, Station LN1, 2012**

Month	Model-Calculated Monthly Average ⁽¹⁾ DO (mg/L)		Model-Calculated Monthly Minimum ⁽¹⁾ DO (mg/L)		Model-Calculated Percent of Time DO \geq 3.0 mg/L ⁽²⁾		Model-Calculated Percent of Time DO \geq 4.8 mg/L ⁽³⁾	
	With Tank	Without Tank	With Tank	Without Tank	With Tank	Without Tank	With Tank	Without Tank
Jan	11.5	11.5	10.0	10.1	100	100	100	100
Feb	13.2	13.3	12.1	12.1	100	100	100	100
Mar	11.9	12.0	10.6	10.8	100	100	100	100
Apr	10.0	10.0	9.2	9.2	100	100	100	100
May	9.1	9.1	7.4	7.4	100	100	100	100
Jun	7.3	7.3	5.4	5.7	100	100	100	100
Jul	5.8	5.8	2.7	2.8	100	100	74.2	74.2
Aug	3.8	3.7	1.8	1.8	83.9	74.2	20.0	13.3
Sep	6.4	6.2	3.7	3.5	100	100	93.3	83.3
Oct	8.9	8.9	6.6	6.3	100	100	100	100
Nov	9.1	9.0	7.9	7.9	100	100	100	100
Dec	10.1	9.9	9.0	8.9	100	100	100	100

Notes:

- (1) Based on 5-minute calculation time step
- (2) Based on hourly calculated values, applicable Class SB acute dissolved-oxygen standard
- (3) Based on daily average calculated values, applicable Class SB chronic dissolved-oxygen standard allows limited excursions below 4.8 mg/L: $DO = 13.0 / (2.8 + 1.84 \exp(-0.1 * t))$

**Table 2-14. Model-Calculated Impact of Alley Creek CSO Retention Facility
On Monthly Dissolved Oxygen, Station E11, 2012**

Month in 2012	Model-Calculated Monthly Average ⁽¹⁾ DO (mg/L)		Model-Calculated Monthly Minimum ⁽¹⁾ DO (mg/L)		Model-Calculated Percent of Time DO \geq 3.0 mg/L ⁽²⁾		Model-Calculated Percent of Time DO \geq 4.8 mg/L ⁽³⁾	
	With Tank	Without Tank	With Tank	Without Tank	With Tank	Without Tank	With Tank	Without Tank
Jan	10.7	10.7	9.4	9.4	100	100	100	100
Feb	12.2	12.2	11.0	11.1	100	100	100	100
Mar	11.7	11.7	10.4	10.5	100	100	100	100
Apr	10.0	10.0	9.1	9.2	100	100	100	100
May	9.7	9.7	8.1	8.1	100	100	100	100
Jun	7.8	7.8	6.5	6.3	100	100	100	100
Jul	6.1	6.1	3.8	3.6	100	100	96.8	96.8
Aug	3.0	2.9	1.0	1.1	32.3	32.3	3.3	3.3
Sep	4.7	4.6	2.1	2.1	96.7	96.7	66.7	63.3
Oct	7.9	7.9	4.3	4.3	100	100	100	100
Nov	8.4	8.4	7.3	7.3	100	100	100	100
Dec	9.5	9.4	8.2	8.2	100	100	100	100

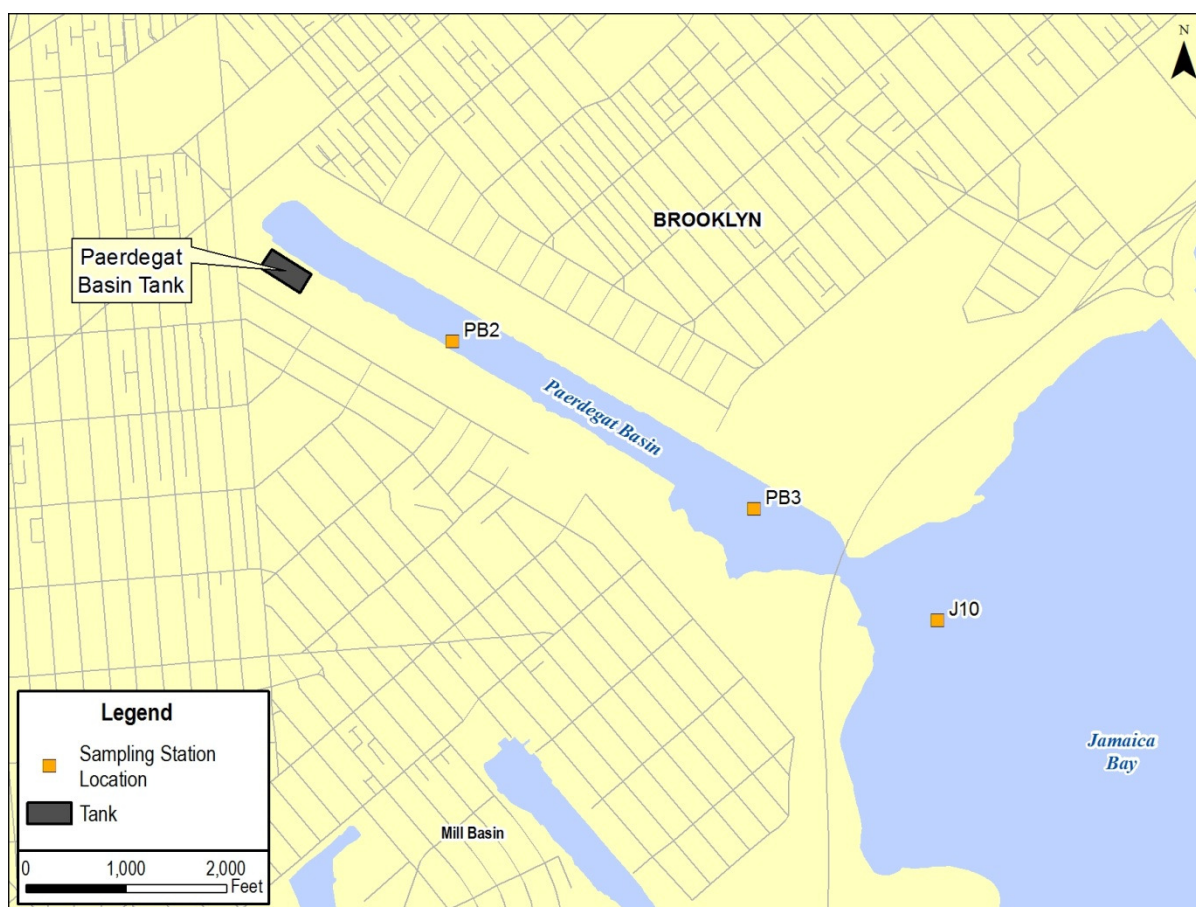
Notes:

- (1) Based on 5-minute calculation time step
- (2) Based on hourly calculated values, applicable Class SB acute dissolved-oxygen standard
- (3) Based on daily average calculated values, applicable Class SB chronic dissolved-oxygen standard allows limited excursions below 4.8 mg/L: $DO = 13.0 / (2.8 + 1.84 \exp(-0.1 * t))$

2.4 WATERS IMPACTED BY THE PAERDEGAT BASIN CSO RETENTION FACILITY

2.4.1 Water Quality Monitoring Results—Paerdegat Basin/Jamaica Bay

Post-construction compliance monitoring for the Paerdegat Basin CSO Retention Facility consists of sample collection at two locations in Paerdegat Basin (stations PB2 and PB3). In addition, DEP's Harbor Survey program samples water quality at one location in Jamaica Bay (station J10). Figure 2-16 presents a map of these station locations.



**Figure 2-16. Paerdegat Basin CSO Retention Facility
Location of Facility and Water-Quality Monitoring Stations**

The Paerdegat Basin / Jamaica Bay monitoring results are tabulated in Appendix M and on Figures 2-17 through 2-20. The results are shown for DO, fecal coliform bacteria, enterococci bacteria, and TSS, respectively. The top panel of each figure shows the daily rainfall for 2012 (at JFK Airport). The second presents the reported overflow volumes discharged from the Paerdegat Basin CSO Retention facility during the same period. The third panel shows the

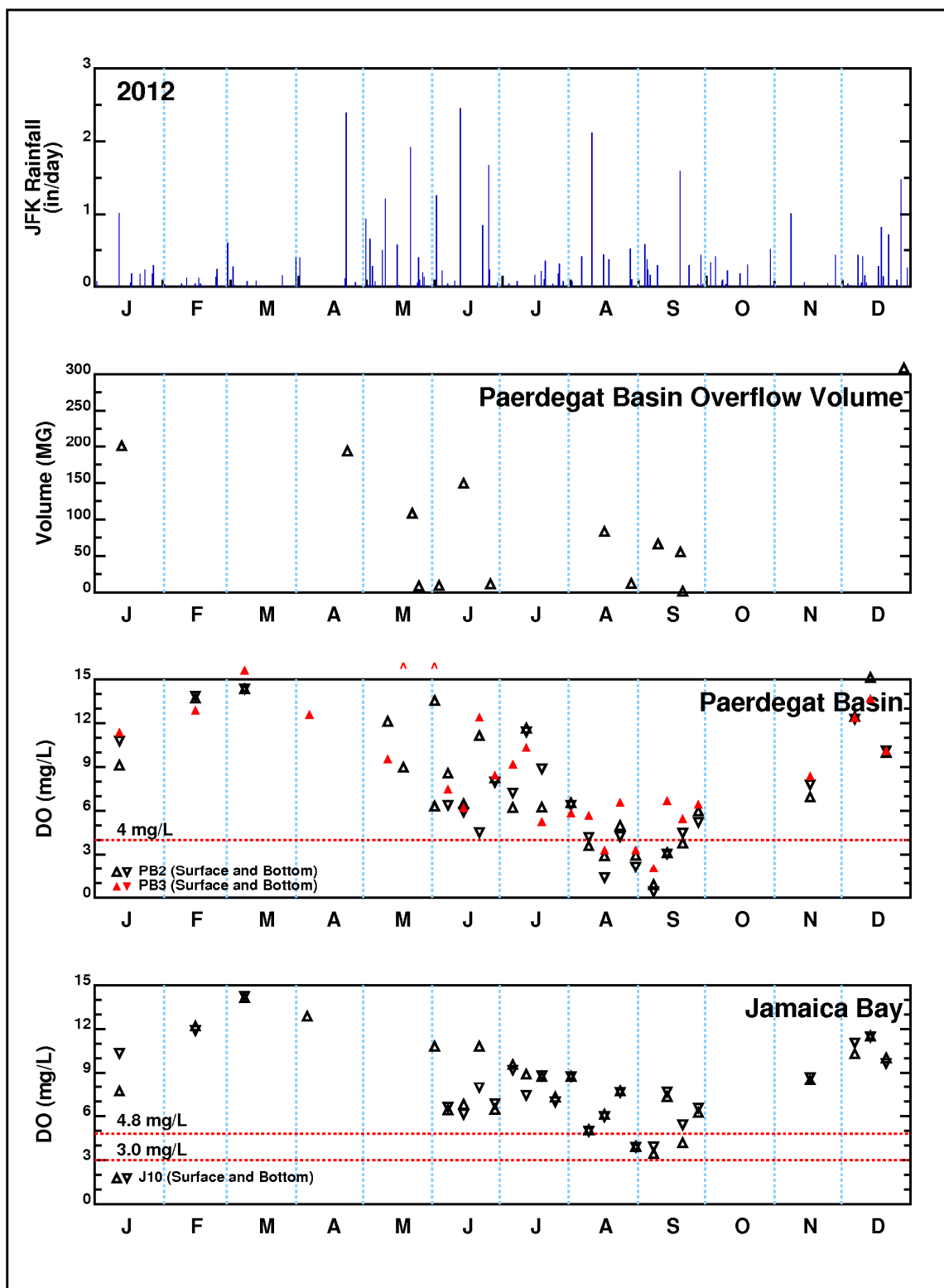
measured constituent concentrations for the stations in Paerdegat Basin, and the bottom panel shows the measured constituent concentrations for the station in Jamaica Bay. Applicable NYS water-quality standards (Class I for Paerdegat Basin and SB for Jamaica Bay) are also shown.

On Figure 2-17, the DO-monitoring results for Paerdegat Basin show excursions below the ≥ 4.0 mg/L standard in August and September. In Jamaica Bay, DO values were occasionally below the chronic standard of ≥ 4.8 mg/L in August and September, and one value was lower than the acute standard of ≥ 3.0 mg/L.

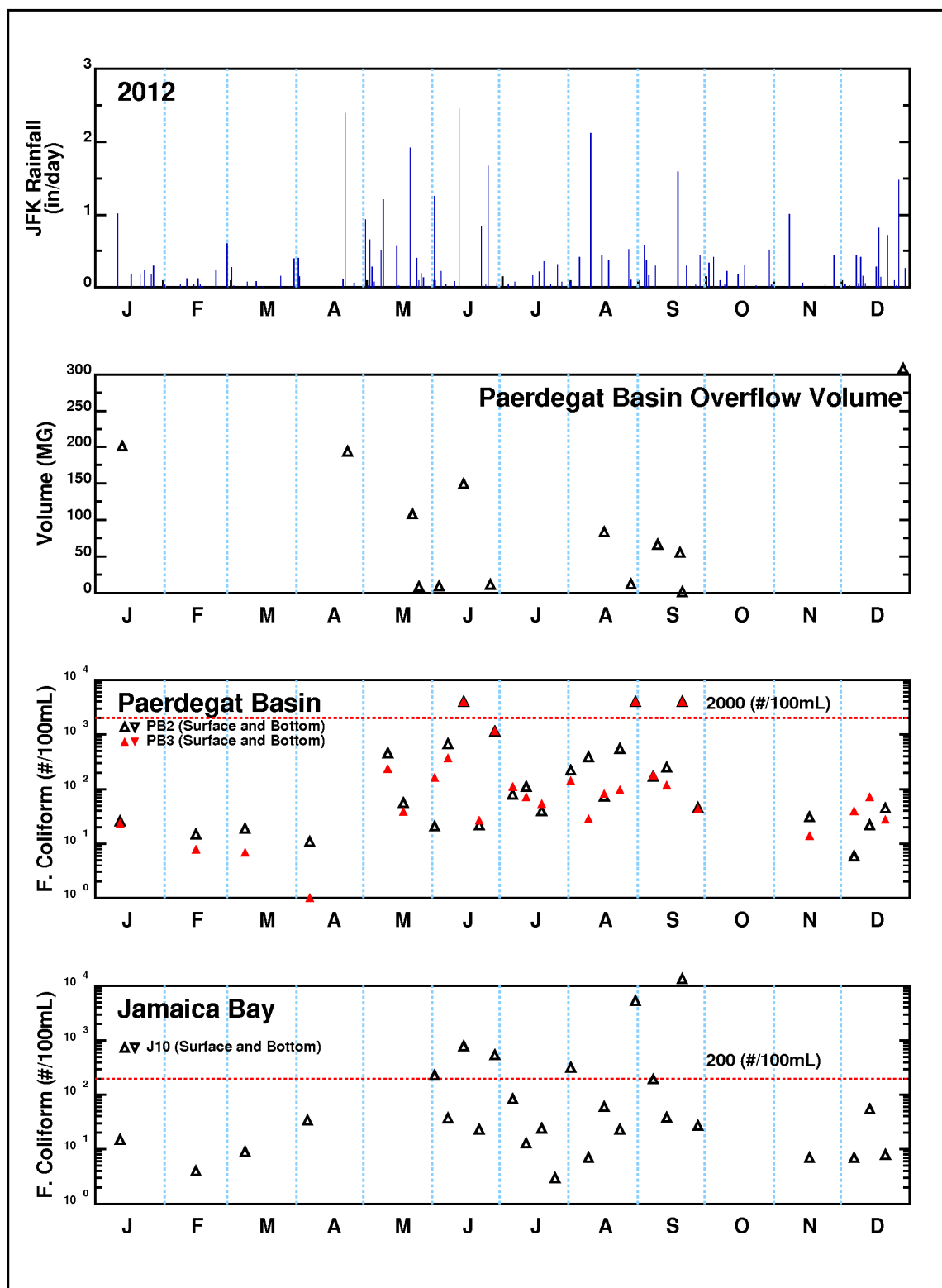
Figure 2-18 presents the fecal-coliform concentrations measured in Paerdegat Basin. Discrete values were generally below the geometric-mean standard ($\leq 2,000$ cells/100mL), with just three measurements above that value. In Jamaica Bay, measurements above the geometric-mean standard of ≤ 200 cells/100mL occurred during May, June, August and September.

As shown on Figure 2-19, enterococci levels in Paerdegat Basin are generally low, with the majority of values below 10 cells/100mL. Two measurements were greater than 100 cells/100mL. In Jamaica Bay, most samples were less than 10 cells/100mL but there were four measurements greater than the geometric mean reference value of ≤ 35 cells/100mL.

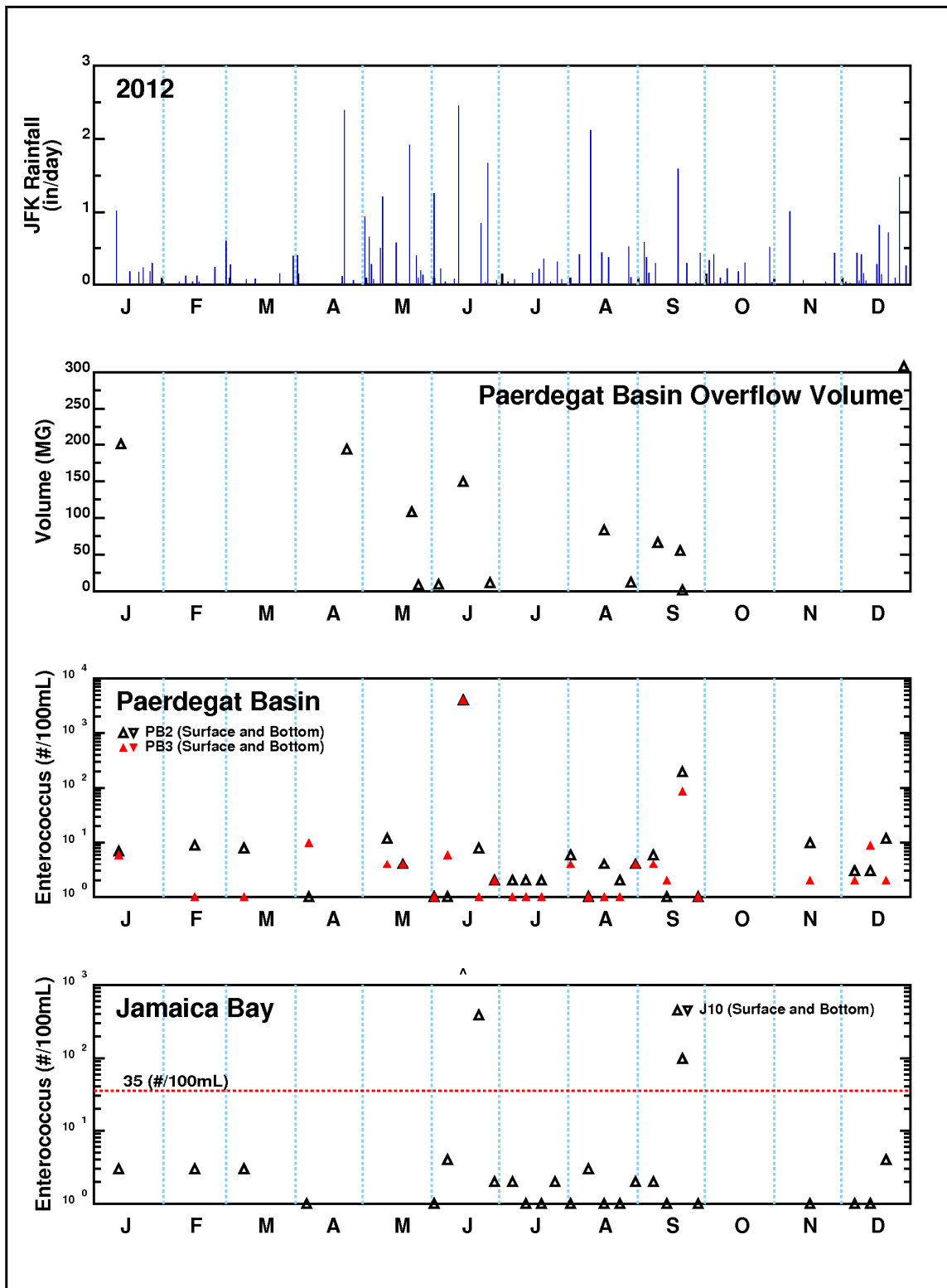
Figure 2-20 presents the results of TSS sampling. Measured TSS concentrations were generally below about 20 mg/L in both Paerdegat Basin and Jamaica Bay.



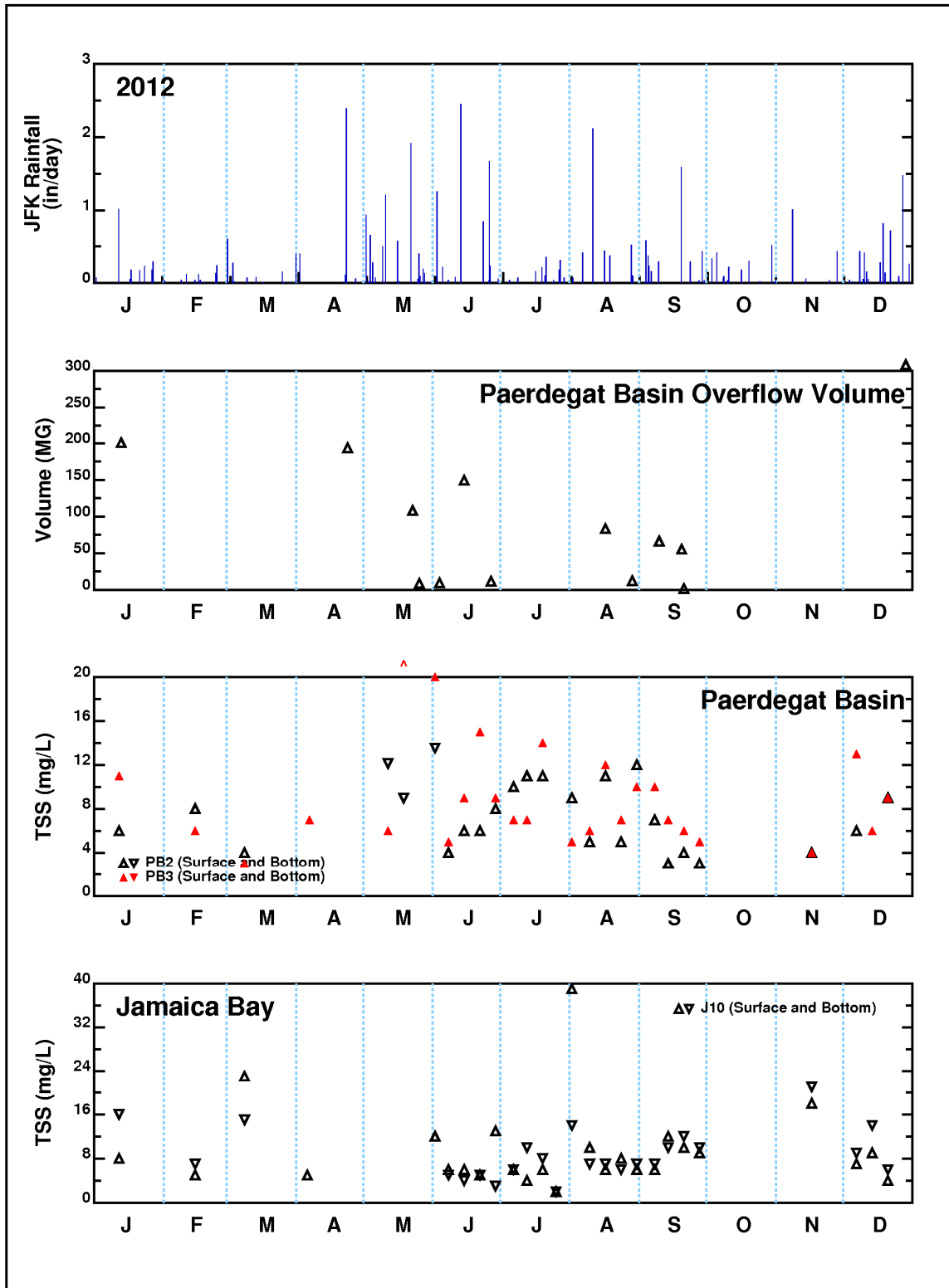
**Figure 2-17. Paerdegat Basin CSO Retention Facility
 Ambient Water-Quality Monitoring – Dissolved Oxygen, 2012**



**Figure 2-18. Paerdegat Basin CSO Retention Facility
 Ambient Water-Quality Monitoring – Fecal Coliform Bacteria, 2012**



**Figure 2-19. Paerdegat Basin CSO Retention Facility
 Ambient Water-Quality Monitoring – Enterococci Bacteria, 2012**



**Figure 2-20. Paerdegat Basin CSO Retention Facility
 Ambient Water-Quality Monitoring – TSS, 2012**

2.4.2 Ambient Water Quality Modeling—Paerdegat Basin/Jamaica Bay

An analysis was performed to investigate the impact of the Paerdegat Basin CSO Retention Facility on receiving-water pathogens and DO. This modeling analysis was performed using the Jamaica Eutrophication Model (JEM) developed as part of the Long Term Control Plan (as described in *Receiving Water Quality Modeling Report, Volume 5, Jamaica Bay Model (JEM)*), and as modified (JEM-LT) with enhanced spatial resolution in Paerdegat Basin and other tributaries as part of work to analyze larval transport in the bay. The JEM-LT model is three-dimensional with ten vertical layers and includes a hydrodynamic component (ECOM) to calculate tidal elevations and velocities. The information from ECOM serves as input to the water quality model (RCA). RCA tracks the fate of pathogen concentrations using first-order decay kinetics, and computes DO concentrations based on complex eutrophication kinetics. As additional monitoring data is collected as part of the PCM program, the modeling analysis can be refined to more accurately explain observed trends and predict response to varying conditions.

Receiving-water model calculations were performed using pollutant-loading inputs generated using results of the InfoWorks collection-system models for the Coney Island wastewater treatment plant service area. InfoWorks model runs were performed using 2012 rainfall and tidal conditions as input (see Section 3). Given the pollutant loadings, the water-quality model was run to generate the ambient concentrations of pathogens and DO, which were then compared to the measurements collected in 2012. A complete set of model/data comparisons is shown in Appendix N (pathogens) and Appendix O (DO). Overall, the 2012 model/data comparisons are favorable in that the modeled results generally track the trends in the data. The model is a useful tool to analyze the impacts of various factors on water quality. As described below, the model can be used to assess the impact of the Paerdegat Basin CSO Retention Facility on water quality in the receiving waters.

2.4.3 Impact Analysis—Paerdegat Basin CSO Retention Facility

To analyze the impact of the Paerdegat Basin CSO Retention Facility on water quality in the receiving water, the InfoWorks collection-system model and the JEM-LT (RCA) water-quality model described above were used to simulate a hypothetical “without-tank” scenario. In the “without-tank” scenario, the Paerdegat Basin facility (including influent channels and the associated storage volume) are removed. Comparison of the results of the “without-tank” condition to results of the existing “with-tank” condition provides the information to evaluate the impacts of the facility. This section summarizes the impacts of the tank on the concentrations of pathogens and DO in the receiving water. Hydraulic impacts of the tank are summarized in Section 3.

Impacts on Pathogen Indicators

Model-calculated monthly geometric-mean concentrations for fecal coliform bacteria, total coliform bacteria, and enterococci bacteria—for both the “with-tank” and “without-tank” scenarios—are shown at several stations (PB2, PB3 and J8) in Appendix P. Table 2-15 summarizes the results at these locations.

Table 2-15. Model-Calculated Impact of Paerdegat Basin CSO Retention Facility on Fecal Coliform Monthly Geometric Mean (MGM) Concentrations, 2012

Month	Model-Calculated Fecal Coliform (MGM, cells/100 mL)			Model-Calculated Fecal Coliform (MGM, cells/100 mL)			Model-Calculated Fecal Coliform (MGM, cells/100 mL)		
	Station PB2			Station PB3			Station J10		
	With Tank	Without Tank	Percent Reduction ⁽¹⁾	With Tank	Without Tank	Percent Reduction ⁽¹⁾	With Tank	Without Tank	Percent Reduction ⁽¹⁾
Jan	45	251	82	21	75	72	13	37	65
Feb	24	99	76	10	26	62	6	11	45
Mar	18	55	67	9	22	59	6	12	50
Apr	16	96	83	11	34	68	8	18	56
May	188	1,067	82	88	395	78	47	167	72
Jun	114	280	59	49	98	50	27	49	45
Jul	11	41	73	5	14	64	3	7	57
Aug	16	79	80	10	31	68	7	16	56
Sep	30	266	89	15	62	76	9	27	67
Oct	29	131	78	14	38	63	8	18	56
Nov	14	123	89	7	33	79	5	16	69
Dec	168	965	83	71	322	78	39	146	73

⁽¹⁾ Percent reduction in concentrations based on change from “without-tank” to “with-tank” condition.

As shown in Table 2-15, the Paerdegat Basin tank provides significant reduction in fecal coliform concentrations in the receiving water. Reductions in the monthly geometric mean (MGM) are considerable, ranging from 59 to 89 percent at the station PB2 and from 45 to 73 percent at J8. Table 2-16 expresses the impact of the tank in terms of monthly attainment of the fecal coliform monthly standard of $\leq 2,000$ cells/100mL. As shown, compliance is 100 percent for both scenarios at all three locations. Although the tank does not impact attainment in this case, it is important to point out that the percent reductions shown in Table 2-15 are significant with regard to the improvement in general water-quality conditions.

Table 2-16. Model-Calculated Impact of Paerdegat Basin CSO Retention Facility on Attainment of Fecal Coliform Monthly Standards – Paerdegat Basin, 2012

Location in Paerdegat Basin	Model-Calculated Percent Attainment of Fecal Coliform Monthly Standard	
	With Tank	Without Tank
Station PB2 ⁽¹⁾	100	100
Station PB3 ⁽¹⁾	100	100
Station J10 ⁽²⁾	100	100
⁽¹⁾ Applicable Class I fecal coliform monthly standard $\leq 2,000$ cells/100mL. ⁽²⁾ Applicable Class I fecal coliform monthly standard ≤ 200 cells/100mL.		

Impacts on Dissolved Oxygen

Tables 2-17 and 2-18 show model-calculated statistics regarding the impact of the tank on DO at the two Paerdegat Basin sampling locations (stations PB2 and PB3). The statistics include average monthly DO concentration, minimum monthly DO concentrations, and the percent of time (hours) during each month that the DO concentration is below the applicable Class I standard of ≥ 4.0 mg/L. Results are summarized for both the “with-tank” and “without-tank” scenarios.

At station PB2, calculated average monthly DO concentrations improve about 0.2 mg/L with the tank for most months. Similarly, calculated monthly minimum DO concentrations improve as much as 1.5 mg/L. The model-calculated percentage of time that DO concentrations attain ≥ 4.0 mg/L each month with the tank increases by as much as 4.7 percentage points (in August).

At station PB3, calculated average monthly DO concentrations improve up to 0.2 mg/L and the calculated minimum monthly DO concentrations improve up to 0.6 mg/L. The model-calculated percentage of time that DO concentrations attain ≥ 4.0 mg/L each month with the tank increases by as much as 4.3 percentage points (in August).

Table 2-19 shows the impact of the tank on DO at station J10. Calculated average monthly DO concentrations do not change, but the calculated minimum monthly DO concentrations improve up to 0.2 mg/L. Calculated attainment of the acute never-less-than 3.0 mg/L criterion is 100 percent for 2012. Calculated attainment of the chronic criterion is 100 percent for all months except August, when daily average concentrations at times dropped below 4.8 mg/L. Calculated August minimum DO at J10 improves 0.2 mg/L with the tank, but the impact of limited excursions below 4.8 mg/L is not accounted for in Table 2-19. Actual attainment with the formulaic standard would be greater than shown in Tables 2-19.

Table 2-17. Model-Calculated Impact of Paerdegat Basin CSO Retention Facility on Monthly Dissolved Oxygen, Station PB2, 2012

Month	Model-Calculated Monthly Average ⁽¹⁾ DO (mg/L)		Model-Calculated Monthly Minimum ⁽¹⁾ DO (mg/L)		Model-Calculated Percent of Time ⁽²⁾ DO ≥ 4.0 mg/L ⁽³⁾	
	With Tank	Without Tank	With Tank	Without Tank	With Tank	Without Tank
Jan	10.5	10.3	9.3	8.4	100	100
Feb	10.0	9.7	8.8	7.9	100	100
Mar	8.6	8.3	4.6	3.1	100	100
Apr	8.3	8.1	5.1	4.1	100	100
May	6.8	6.6	3.1	2.6	99	97
Jun	6.1	5.9	0.5	0.0	96	96
Jul	5.4	5.2	1.1	0.6	91	87
Aug	4.2	4.0	0.2	0.1	54	50
Sep	6.4	6.2	0.7	0.3	92	90
Oct	7.6	7.5	5.7	5.5	100	100
Nov	9.3	9.3	8.2	7.9	100	100
Dec	10.0	10.1	8.8	8.6	100	100
Notes: (1) Based on 5-minute calculation time step (2) Based on hourly calculated values (3) Applicable Class SB chronic dissolved-oxygen standard allows limited excursions below 4.8 mg/L						

Table 2-18. Model-Calculated Impact of Paerdegat Basin CSO Retention Facility On Monthly Dissolved Oxygen, Station PB3, 2012

Month in 2012	Model-Calculated Monthly Average ⁽¹⁾ DO (mg/L)		Model-Calculated Monthly Minimum ⁽¹⁾ DO (mg/L)		Model-Calculated Percent of Time ⁽²⁾ DO ≥ 4.0 mg/L ⁽³⁾	
	With Tank	Without Tank	With Tank	Without Tank	With Tank	Without Tank
Jan	10.7	10.6	9.7	9.2	100	100
Feb	10.3	10.2	9.2	8.7	100	100
Mar	9.3	9.1	7.2	6.7	100	100
Apr	8.8	8.7	5.1	4.5	100	100
May	7.7	7.6	3.1	2.7	100	100
Jun	7.0	6.9	2.7	2.4	99	99
Jul	6.2	6.1	2.1	1.8	95	94
Aug	3.9	3.8	0.8	0.4	49	45
Sep	6.2	6.1	2.3	2.0	96	95
Oct	7.7	7.7	5.5	5.3	100	100
Nov	9.4	9.4	7.6	7.5	100	100
Dec	10.1	10.2	9.3	9.1	100	100
Notes: (1) Based on 5-minute calculation time step (2) Based on hourly calculated values (3) Applicable Class I dissolved-oxygen standard						

**Table 2-19. Model-Calculated Impact of Paerdegat Basin CSO Retention Facility On
Monthly Dissolved Oxygen, Station J10, 2012**

Month	Model-Calculated Monthly Average ⁽¹⁾ DO (mg/L)		Model-Calculated Monthly Minimum ⁽¹⁾ DO (mg/L)		Model-Calculated Percent of Time DO \geq 3.0 mg/L ⁽²⁾		Model-Calculated Percent of Time DO \geq 4.8 mg/L ⁽³⁾	
	With Tank	Without Tank	With Tank	Without Tank	With Tank	Without Tank	With Tank	Without Tank
Jan	10.9	10.9	10.4	10.4	100	100	100	100
Feb	10.5	10.5	10.1	10.0	100	100	100	100
Mar	9.7	9.6	9.0	8.9	100	100	100	100
Apr	9.2	9.2	8.5	8.3	100	100	100	100
May	8.6	8.6	7.6	7.5	100	100	100	100
Jun	7.9	7.9	6.8	6.7	100	100	100	100
Jul	7.3	7.3	4.9	4.9	100	100	100	100
Aug	4.4	4.4	3.2	3.0	100	100	16.1	16.1
Sep	6.4	6.4	4.6	4.6	100	100	100	100
Oct	7.9	7.9	7.2	7.2	100	100	100	100
Nov	9.6	9.6	8.2	8.2	100	100	100	100
Dec	10.3	10.3	9.9	9.9	100	100	100	100
Notes: (1) Based on 5-minute calculation time step (2) Based on hourly calculated values, Class SB acute criterion (3) Based on daily average calculated values, Class SB chronic criterion, allows limited excursions below 4.8 mg/L: $DO = 13.0 / (2.8 + 1.84 \exp(-0.1 * t))$								

3.0 FACILITY OPERATIONS – FLOW MONITORING AND EFFLUENT QUALITY

Section 3.0 summarizes the flow monitoring and effluent water quality data collected for the CSO Retention Facilities at Spring Creek, Flushing Bay, Alley Creek and Paerdegat Basin during 2012. Appendix Q contains storm-event statistics at the National Weather Service gauges at LaGuardia Airport and JFK Airport. Appendix R contains the monthly CSO Retention Facility Operation Reports for each tank, which include overflow start and end times, overflow volumes, and where available, results of water-quality sampling screenings volumes.

3.1 SPRING CREEK CSO RETENTION FACILITY

3.1.1 Spring Creek CSO Retention Facility Flow/Volume

Data Summary

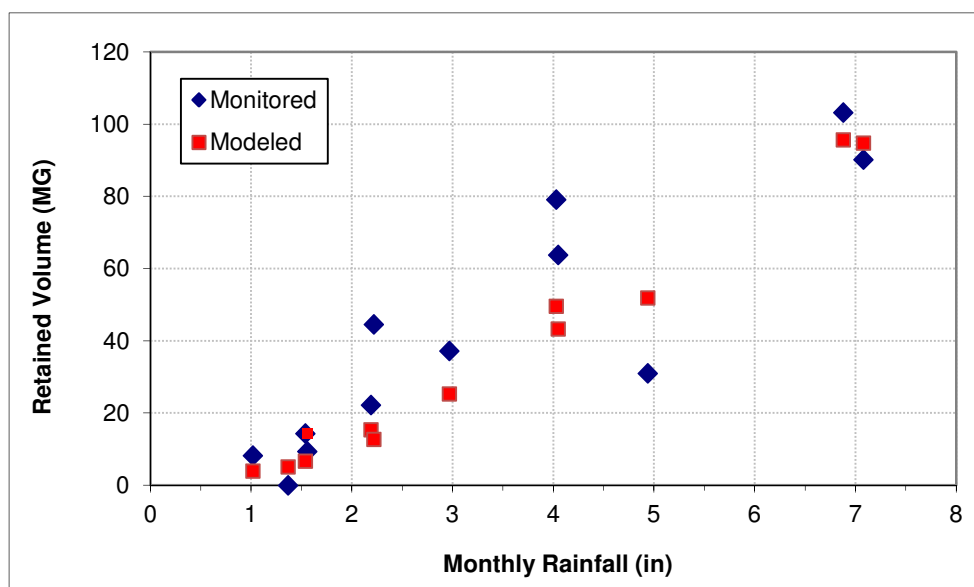
DEP monitors water-surface elevations and gate positions at various locations within the Spring Creek CSO Retention Facility over time. Based on this information, DEP estimates retained volume in the tank (and, as of December 2008, in the influent barrels) and overflow volumes discharged from the tank during each storm event. These calculations are estimates based on hydraulic equations and trend analyses and are not direct measurements. DEP estimates the retained volume (i.e., volume captured for treatment at the 26th Ward WWTP) by assessing water-level trends in the basin throughout the month, excluding periods while effluent gates are open. DEP estimates the tank overflow volumes based on hydraulic equations and the height of the basin water above the effluent weir while effluent gates were open. The total volume entering the tank is calculated as the sum of the retained and overflow volumes. DEP reports estimated daily inflow and infiltration (I/I), wet-weather retained volume, gravity flow and pumped flow to the 26th Ward WWTP, overflow periods and overflow volume in monthly operation reports submitted to the NYSDEC (see Appendix R). Tables 3-1 and 3-2 present a summary of the monthly and per-overflow-event estimates provided to NYSDEC, respectively. Storm-event statistics for JFK Airport are summarized in Appendix Q.

Analysis of rainfall data recorded at JFK Airport indicates that 2012 had 127 storms totaling 39.85 inches. Table 3-1 summarizes monthly rainfall and tank-monitoring data. Monthly monitoring data are summarized graphically on Figures 3-1 and 3-2. Figure 3-1 presents the retained volume versus rainfall and illustrates how monthly retained volume (including volume stored in the influent barrels) increases with monthly rainfall. Figure 3-2 presents monthly overflow volume versus monthly rainfall.

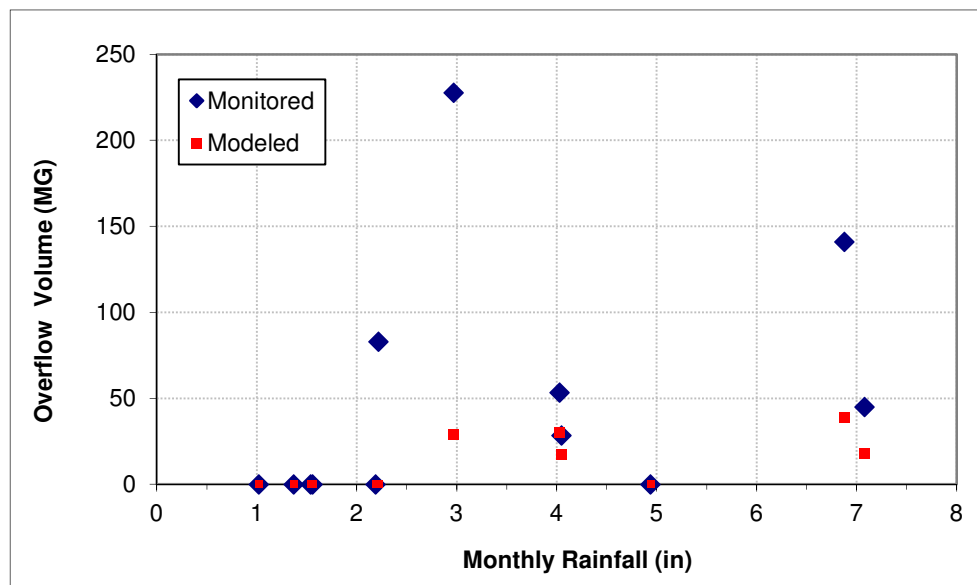
**Table 3-1. Spring Creek CSO Retention Facility –
Estimated Monthly Retained Volumes and Overflow Volumes, 2012**

Month	Rain at JFK (in)	Monthly Information Reported to NYSDEC ⁽¹⁾			InfoWorks Model Results		
		Retained Volume (MG)	Overflow Events (Count)	Overflow Volume (MG)	Retained Volume (MG)	Tank Overflow Events (Count)	Tank Overflow Volume (MG)
January	2.19	22	0	0	15	0	0
February	1.37	0	0	0	5	0	0
March	1.02	8	0	0	4	0	0
April	2.97	37	1	228	25	1	29
May	7.08	90	1	45	95	1	18
June	6.88	103	3	141	96	3	39
July	1.54	14	0	0	7	0	0
August	4.03	79	1	53	50	1	30
September	4.05	64	1	29	43	1	17
October	2.22	45	1	83	13	0	0
November	1.56	9	0	0	14	0	0
December	4.94	31	0	0	52	0	0
Totals:	39.85	503	8	578	419	7	133

⁽¹⁾ From monthly operation reports



**Figure 3-1. Monthly Retained Volume vs. Rainfall,
Spring Creek CSO Retention Facility, 2012**



**Figure 3-2. Monthly Overflow Volume vs. Rainfall,
Spring Creek CSO Retention Facility, 2012**

Inflow and Infiltration (I/I)

Even during dry weather, the Spring Creek tank collects a combination of I/I from the influent sewers and tidal backflow through the facility sluice gates. To quantify the I/I, DEP tracks the water-surface elevations in the tank cells and estimates¹ the overall I/I on a daily and monthly basis. The I/I estimates are reported to NYSDEC in the facility monthly operation reports. In 2012, the average I/I rate was 0.49 MGD, with monthly average values ranging from 0.24 to 0.90 MGD and a highest daily estimate of 7.2 MGD on a wet-weather day. The Spring Creek tank is operated such that I/I volumes are pumped back to the WWTP prior to anticipated wet-weather events to minimize the impact on wet-weather capture of combined sewage at the facility.

InfoWorks Modeling

In accordance with the DEC-approved protocol described in *Calculation of Combined Sewer Overflows from Remote Control Facilities*, March 2004, DEP has performed sewer-system modeling for the reporting of CSO facility characteristics as part of the CSO BMP annual reporting effort. This modeling, as noted in the 2004 report, is conducted using the InfoWorks hydrologic/hydraulic modeling framework. Ongoing recalibration work has been performed as

¹ For the Spring Creek facility, DEP's monthly reporting to DEC indicates that "the I/I rate is estimated by observing basin trends throughout the month. All increases in basin elevation during dry weather are reported as I/I."

described most recently in the *InfoWorks Citywide Recalibration Report, Updates to and Recalibration of October 2007 NYC Landside Models*, June 2012). Table 3-1 summarizes the results of the InfoWorks modeling for the Spring Creek CSO Retention Facility.

The number of overflow events and the associated overflow volume during each event of 2012 were estimated using the latest available InfoWorks model of the 26th Ward / Jamaica WWTP drainage areas. This model was initially constructed and calibrated during the Citywide CSO Long-Term Control Planning (LTCP) project (as described in the *Landside Modeling Report – Volume 1, 26th Ward WWTP* (October 2007). Subsequent updates were made to include revisions to the invert and overflow-weir elevations at Regulator 3, the overflow-weir elevation at the facility, facility dimensions, and the operating “rules” at the facility (including operation of the effluent sluice gates) to better reflect conditions following the facility re-construction completed in April 2007. Recalibration has made use of flow metering conducted at various points throughout the sewer system. Additional recalibration work was performed in 2012 to refine the identification of pervious areas and their associated hydrology (as described in the *InfoWorks Citywide Recalibration Report, Updates to and Recalibration of October 2007 NYC Landside Models*, June 2012).

Table 3-1 presents a comparison of the InfoWorks-calculated retained volume, number of overflows and overflow volumes to the monitoring-based DEP calculations for 2012, both overall and on a monthly basis. Figures 3-1 and 3-2 present these comparisons graphically. As shown, the model compares reasonably well with the monitoring-based DEP calculations for retained volumes, with annual-total retained volumes of 419 and 578 MG, respectively. However, the model-calculated overflow volumes are typically lower than the DEP-reported overflow volumes, with annual-total overflow volumes of 133 and 578 MG, respectively.

Discrepancies between actual overflows and model-predicted overflows are often attributable to the fact that the model results are based on the rainfall at JFK Airport being taken to represent the rainfall over the entire drainage area. In reality, storms move through the area so that the rainfall actually varies over time and space. Since rainfall patterns tend to even out over the area over time, the practice of using the rainfall measured at one nearby location typically provides good agreement with long-term performance for the collection system as a whole; however, model results for any particular storm may vary somewhat from the observed.

Table 3-2 presents event-specific overflow information for 2012 (additional event-specific overflow information is also provided in Appendix Q.) Overall, the model projected 7 overflow events during 2012, compared to 8 observed overflow events. However, some storms for which the model projected overflows did not actually produce overflows (June 10, August 10, and September 18), and other storms for which the model did not project overflows actually

did produce overflows (June 2, June 23, August 15, September 8, and October 29). As noted above, these discrepancies are partly explained by differences in rainfall patterns that actually occurred over the facility drainage area versus the rainfall observed at JFK Airport (used in the model). Though these rainfall discrepancies could be resolved by using distributed (radar) rainfall in the model, this effort focused on annual calculations for which use of point rainfall information is generally sufficient. Another part of the discrepancy between the model calculations and the monitor-based estimates is that the overflow rates are not directly measured at Spring Creek, but are based on level sensor data and application of weir equations for either submerged or free-discharge conditions.

Table 3-2. Spring Creek Retention Facility - Overflow Data and InfoWorks Model Results, 2012

Over-Flow Begin Date	Rain at JFK (in)	Monthly Information Reported to NYSDEC						InfoWorks Model Calculations			
		Overflow Vol. ⁽¹⁾ (MG)	BOD ₅ (mg/L)	TSS (mg/L)	O&G (mg/L)	Settleable Solids (mL/L)	F. Coli Geo. Mean (No. /100mL)	Overflow Volume (MG)	BOD ₅ (mg/L)	TSS (mg/L)	F. Coli Geo. Mean (No. /100mL)
4/22	2.39	228	42	88	NR	NR	NR	29	28	28	4.2E+05
5/21	1.92	45	68	85	0.5	17	20.0E+05	18	25	25	3.2E+05
6/2	1.26	18	60	60	NR	NR	NR	0.03	32	32	5.3E+05
6/13	2.45	105	55	196	NR	NR	NR	27	26	26	3.6E+05
6/23	0.84	18	54	114	NR	NR	NR	No	-	-	-
6/25	1.67	No						12	25	25	3.2E+05
8/10	2.12	No						30	23	23	2.8E+05
8/15	0.44	53	71	164	NR	NR	NR	No	-	-	-
9/8	0.29	28	61	124	NR	NR	NR	No	-	-	-
9/18	1.59	No						17	27	27	3.9E+05
10/29	0.51	83	276	535	NR	NR	NR	No	-	-	-
Count	-	8	-	-	-	-	-	7	-	-	-
Mean⁽³⁾	-	-	81	162	0.5	17	20.0E+05	-	26	26	3.5E+05
Total	-	578	-	-	-	-	-	133	-	-	-

⁽¹⁾ Based on trend analysis of measured water-surface elevations within the tank and hydraulic calculations. "No" means no overflow occurred
⁽²⁾ Monthly operation report shows two individual overflows for the same rain event
⁽³⁾ Annual means provided for comparison purposes. Overall mean for annual period computed as geometric mean for bacteria.
NR = no data reported. Sampling not required when facility not manned

3.1.2 Spring Creek CSO Retention Facility Effluent Quality

Data Summary

Overflow effluent quality for 2012 is summarized in Table 3-2 and in Appendix Q. Overflow events during which effluent quality was measured corresponded to storm events measuring from 0.29 to 2.45 inches of rainfall at JFK Airport. Observed BOD₅ concentrations ranged from 42 to 276 mg/L and averaged 86 mg/L, while TSS concentrations ranged from 60 to 535 mg/L and averaged 171 mg/L. Measurements of oil & grease, settleable solids and fecal coliform were available for only one event in 2012. Disinfection of tank overflows is not required.

In addition to the water-quality constituents mentioned above, screenings volumes removed during tank pump-down are also tracked and reported monthly to NYSDEC. Table 3-3 presents the collected screenings volumes on a monthly (average 41 cubic yards) and annual-total (490 cubic yards) basis in 2012.

**Table 3-3. Spring Creek CSO Retention Facility
Collected Screenings, 2012**

Month	Collected Screenings (cubic yards)
January	90
February	60
March	70
April	50
May	70
June	10
July	50
August	10
September	0
October	40
November	10
December	30
Annual Total	490
Average per Month	41

InfoWorks Modeling

Estimates of tank-overflow pollutant loads for effluent BOD₅, TSS and Fecal coliform were developed using the methodology developed during the CSO Long-Term Control Plan

(LTCP) project. Effluent pollutant concentrations were estimated by assigning typical sanitary and stormwater concentrations to the corresponding sanitary and stormwater portions of the overflow (as estimated by the InfoWorks model). The assigned concentrations of the sanitary portion of the overflow were 150 mg/L for BOD₅, 150 mg/L for TSS, and 4,000,000/100mL for fecal coliform. The assigned concentrations of the stormwater portion of the overflow were 15 mg/L for BOD₅, 15 mg/L for TSS, and 35,000/100mL for fecal coliform. As shown in Table 3-2, the 9 observed concentrations show considerable variation and typically higher concentrations than computed. It should be noted that the model-calculated concentrations were developed for comparison purposes only; the water-quality model of Spring Creek (as described in Section 2 herein) utilizes dissolved and particulate carbon forms rather than BOD₅ and TSS to calculate impacts on dissolved oxygen.

3.1.3 Spring Creek CSO Retention Facility Impacts

The InfoWorks model was used to estimate the annual CSO discharges to the Spring Creek waterbody with respect to overflow volume and associated loadings of fecal coliform, BOD₅, and TSS for two scenarios: the current “with tank” condition and a hypothetical “without tank” condition. Table 3-4 summarizes the results of these calculations.

Table 3-4. Model-Calculated Impact of the Spring Creek CSO Retention Facility on CSO Discharges to Spring Creek, 2012

Parameter	CSO Discharges to Spring Creek		
	Without Tank	With Tank	Percent Reduction With Tank
Overflow Events (count) ⁽¹⁾	14	7	50
Overflow Volume (MG)	366	133	64
BOD ₅ (lb) ⁽²⁾	72,878	28,570	61
TSS (lb) ⁽²⁾	72,878	28,570	61
Fecal Coliform (cells) ⁽²⁾	4.1E+15	1.8E+15	57
⁽¹⁾ Number of rainfall events causing CSO. ⁽²⁾ Based on application of InfoWorks-calculated sanitary/stormwater fractions of discharges, with sanitary –sewage concentrations of 150 mg/L BOD ₅ , 150 mg/L TSS, and 4.0E+06 cells/100mL Fecal Coliform, and stormwater concentrations of 15 mg/L BOD ₅ , 15 mg/L TSS, and 3.5E+05 cells/100mL Fecal Coliform.			

As shown in Table 3-4, the results of the modeling analysis indicate that the Spring Creek tank reduces occurrences of CSOs to the Spring Creek waterbody by 50 percent, CSO volume by 64 percent, pollutant discharges by about 61 percent, and pathogen discharges by about 57 percent, relative to the “without-tank” condition.

In addition to its other water-quality benefits, the retention facility also removes floatables that would otherwise discharge to the receiving water. As shown in Table 3-3, an annual total of 490 cubic yards of screenings were removed from the Spring Creek facility in 2012. Without the facility, 490 cubic yards of floatable material presumably would have discharged to the receiving water.

3.2 FLUSHING BAY CSO RETENTION FACILITY

3.2.1 Flushing Bay CSO Retention Facility Flow/Volume

Data Summary

DEP monitors water-surface elevations and flow rates at various locations within the Flushing Bay CSO Retention Facility. Based on these measurements, DEP estimates daily inflow and infiltration (I/I), wet-weather retained volumes, pump-back volumes, overflow periods and overflow volumes. DEP reports these estimates to the NYSDEC in monthly operation reports (see Appendix J). Tables 3-5 and 3-6 present a summary of the monthly and per-overflow-event estimates, respectively (additional information is provided in Appendix Q). Monthly monitoring data are also summarized graphically on Figures 3-3 (monthly total retained volume pumped back for treatment) and 3-4 (monthly overflow volume).

Analysis¹ of rainfall data recorded at the National Weather Service’s LaGuardia Airport (LGA) gauge indicates that 2012 had 125 storms totaling 36.18 inches. Monthly rainfall ranged from 0.91 to 5.06 inches. As summarized in Table 3-5, the Flushing Bay tank overflowed during 14 storm events in 2012, meaning the tank fully captured flow generated during the other 89 percent (111) of the rainfall events in 2012. DEP reported that the tank retained a total of 2,870 MG pumped back to the Tallman Island WWTP for treatment, while about 150 MG overflowed from the tank itself.

¹ Analyses of rainfall statistics performed using EPA’s SYNOP program using minimum inter-event time of 4 hours and minimum storm threshold of zero inches.

**Table 3-5. Flushing Bay CSO Retention Facility
Estimated Monthly Retained Volumes and Overflow Volumes, 2012**

Month	Rain at LGA (in)	Monthly Information Reported to NYSDEC			Model Results		
		Retained Volume ⁽¹⁾ (MG)	Tank Overflow Events (Count)	Tank Overflow Volume (MG)	Retained Volume ⁽²⁾ (MG)	Tank Overflow Events (Count)	Tank Overflow Volume (MG)
January	2.51	235	1	4	226	1	4
February	1.43	156	0	0	166	0	0
March	0.91	174	0	0	189	0	0
April	3.18	190	1	6	215	1	78
May	4.67	293	1	18	295	1	7
June	4.19	268	2	17	275	2	45
July	3.77	255	1	0	229	1	69
August	2.95	299	1	9	263	1	2
September	5.06	241	2	23	276	4	89
October	1.86 ⁽³⁾	256	2	12	230	0	0
November	1.35	207	0	0	169	0	0
December	4.30	297	3	60	224	3	29
Totals:	36.18	2,870	14	150	2,757	14	324
(1) Reported (DEP calculated) retained volumes are based on pumpback values included I/I in dry weather (2) Model-calculated retained volumes include all I/I retained in the tank, even in dry weather. (3) NOAA daily readings at LGA show 2.39 inches in October, versus 1.86 inches from hourly values. NOAA attributed this discrepancy to hourly measurement irregularities during Hurricane Sandy and stated that the daily total value is more reliable.							

Figures 3-3 and 3-4 graphically illustrate the relationship between monthly rainfall and the reported total monthly volume retained and pumped back to the Tallman Island WWTP, and total monthly overflow volume, respectively. As shown, monthly retained volume tends to increase with monthly rainfall up to about 3 inches, beyond which the retained volume levels off. Monthly overflow volumes tend to increase once monthly rainfall exceeds about 3 inches. Together, these graphics indicate that the Flushing Bay tank generally operates in a manner that fully captures up to about 3 inches of rainfall each month. Months with more than 3 inches of rainfall tend to have higher overflow volumes than months with less than 3 inches of rainfall.

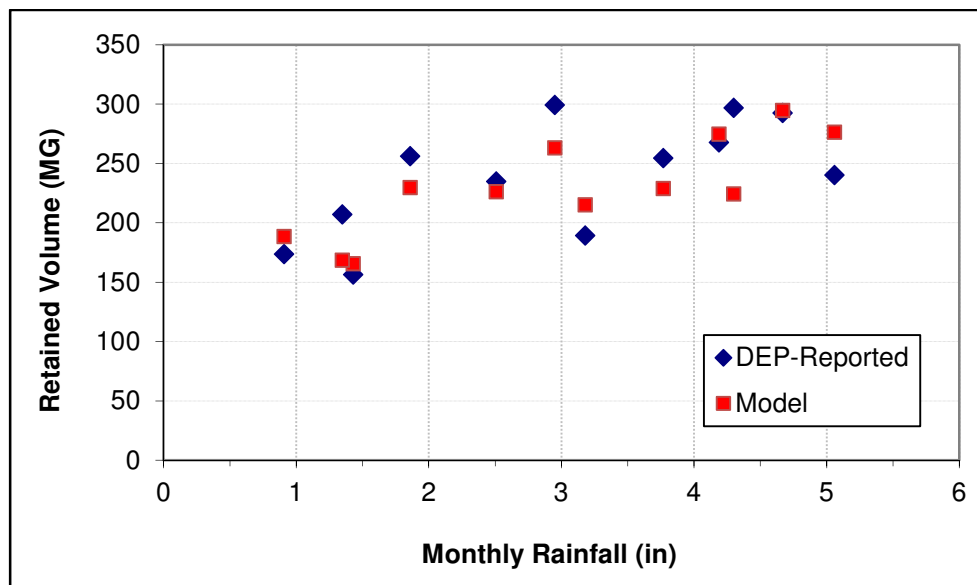


Figure 3-3. Monthly Total Retained Volume vs. Rainfall, Flushing Bay CSO Retention Facility, 2012

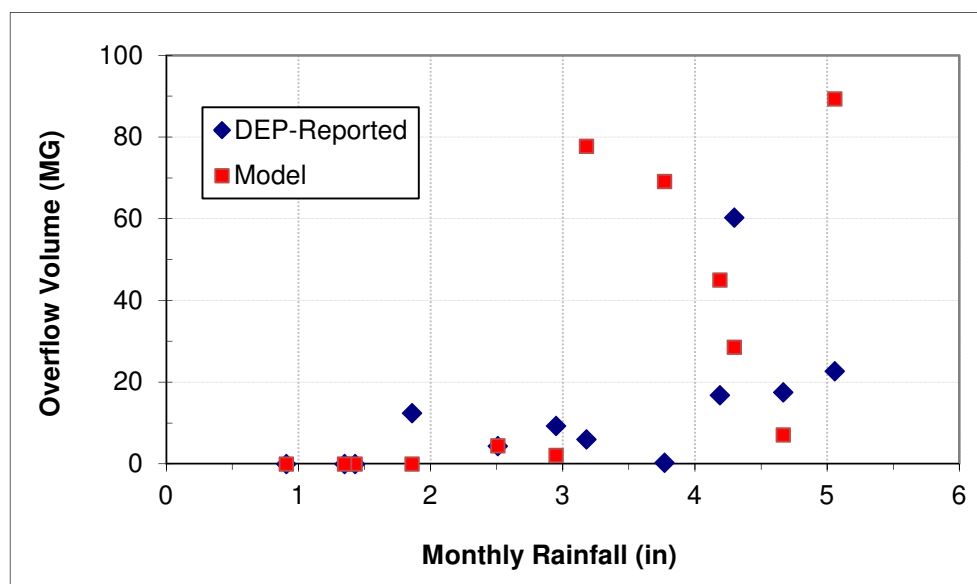


Figure 3-4. Monthly Overflow Volume vs. Rainfall, Flushing Bay CSO Retention Facility, 2012

Inflow and Infiltration (I/I)

Even during dry weather, the Flushing Bay CSO Retention Facility accumulates flow due to inflow and infiltration (I/I) into the upstream collection system. DEP estimates the I/I by tracking the tank pump-down during dry-weather periods¹. Results are included in the monthly facility operation reports submitted to the NYSDEC. In 2012, the average I/I rate was about 5.3 MGD, with monthly average values ranging from 4.3 to 6.9 MGD, and a highest daily estimate of 16.9 MGD (which actually occurred immediately following a rainfall event). I/I volumes are pumped from the tank to maximize the storage available for wet-weather events.

InfoWorks Modeling

In accordance with the DEC-approved protocol described in *Calculation of Combined Sewer Overflows from Remote Control Facilities*, March 2004, DEP has performed sewer-system modeling for the reporting of CSO facility characteristics as part of the CSO BMP annual reporting effort. This modeling, as noted in the 2004 report, is conducted using the InfoWorks hydrologic/hydraulic modeling framework for the Tallman Island and Bowery Bay WWTP service areas (part of the latter can tip flow into the Flushing Bay facility service area during wet weather). These models were initially constructed and calibrated during the Citywide CSO Long-Term Control Planning (LTCP) project (as described in the *Landside Modeling Report – Volume 13, Tallman Island WWTP*, and *Volume 2, Bowery Bay WWTP* (both October 2007)). Subsequent recalibration work was performed in 2012 to refine the way in which pervious areas were identified and their associated hydrology was analyzed (as described in the *InfoWorks Citywide Recalibration Report, Updates to and Recalibration of October 2007 NYC Landside Models*, June 2012). In addition, calibration efforts associated with the Alley Creek LTCP analysis began in early 2013 involving the Tallman Island WWTP service area InfoWorks model. These developments have improved the ability of the modeling framework to more accurately represent the hydrology and hydraulics of the Tallman Island WWTP collection system.

Table 3-5 and Figures 3-3 and 3-4 (above) summarize the InfoWorks model results for the Flushing Bay CSO Retention Facility in comparison to the monitoring-based values from DEP's monthly operation reports. As shown, the model-calculated annual retained volume of 2,757 MG compares favorably to the monitoring-based value of 2,870 MG, particularly considering that the model calculation is based on rainfall measured at a single point (LaGuardia Airport) rather than a distributed rainfall over the facility service area. Although the month-to-month values can vary somewhat due to differences in rainfall, these differences tend to even out

¹ DEP estimates daily dry-weather I/I as the pump back volume plus the change in the total retained volume from 7am to 7am. On wet-weather days, I/I is taken as the average during dry-weather days that month.

over the course of the year. With respect to overflow events, the calculated annual number of 14 compares well to the observed number, but again the month-to-month values can vary due to differences in rainfall. The calculated total annual overflow volume of 324 MG is significantly higher than the monitoring-based value of 150 MG. Since overflow amounts are highly dependent on individual storms (rather than monthly total rainfalls), this discrepancy may also be due to the discrepancy between assigning a point rainfall pattern over the entire service area rather than using a spatially-distributed pattern. Storm-specific results are described below.

Table 3-6 presents storm-specific results for events in which overflows were observed or calculated using the model. Discrepancies between the observed and model-calculated overflow results are explained below. Because the actual rainfall patterns over the facility's drainage area may differ from those measured at LaGuardia Airport, the modeling results (which are based on rainfall measured at LaGuardia Airport) may differ somewhat from those observed.

The InfoWorks model calculations indicated that overflows totaling 64 MG occurred during 3 storms for which no overflows were reported: June 2, August 27, and September 18. In these cases, deviations in rainfall patterns or facility operations may explain the discrepancies.

The InfoWorks model calculations did not predict 4 observed overflow events totaling 35 MG: June 23, August 15, and October 29 and 30 (Hurricane Sandy). In each of these cases, the facility service area experienced more rain than indicated by the LaGuardia rain gauge. Inspection of radar images from the June 23 and August 15 events shows that the service area actually received an inch or more of rainfall (more than observed at LaGuardia Airport, which is what the model calculations are based upon). Besides other extenuating circumstances such as power outages and extreme tidal flooding, information from NOAA indicates that the posted hourly rainfall data (which was used as model input) was both substantially less than and less reliable than the posted daily total rainfalls.

3.2.2 Flushing Bay CSO Retention Facility – Effluent Quality

Data Summary

Overflow effluent quality for 2012 is summarized in Table 3-6 and in Appendix Q. Water-quality sampling of tank effluent (overflow) was reported for most overflow events. Observed BOD₅ concentrations ranged from 7 to 75 mg/L and averaged about 29 mg/L for the year, while TSS concentrations ranged from 15 to 60 mg/L and averaged about 35 mg/L. Oil and grease (O&G) concentrations ranged from less than 0.5 to 10.5 mg/L and averaged about 6 mg/L, and settleable solids were generally under detection limits. Disinfection of tank overflows is not performed.

In addition to the water-quality constituents mentioned above, screenings volumes removed during tank pump-down are also tracked and reported monthly to NYSDEC. Table 3-7 summarizes the monthly screenings volumes collected and indicates a total of 424 cubic yards during the year (average 35 cubic yards per month on an annual basis, or about 60 cubic yards per non-zero month).

Table 3-6. Flushing Bay Tank Overflow Event Data and Model Comparison, 2012

Over Flow Begin Date	Rain at LGA ⁽¹⁾ (in)	Information Reported to NYSDEC						Model Calculations			
		Overflow Volume ⁽⁴⁾ (MG)	BOD ₅ (mg/L)	TSS (mg/L)	Oil & Grease (mg/L)	Settleable Solids (mg/L)	F. Coli Geo. Mean (cells /100mL)	Overflow Volume (MG)	BOD ₅ (mg/L)	TSS (mg/L)	F. Coli Geo. Mean (cells /100mL)
1/12	1.04	4.4	13	23	NR	NR	NR	4.3	23	22	2.9E+05
4/22	2.11	6.0	27	31	NR	NR	NR	78.2	22	22	2.6E+05
5/21	1.24	17.5	17	27	NR	NR	NR	7.2	23	22	2.9E+05
6/2	1.11	No	22	32	<0.5	0.1	TNTC	19.8	21	21	2.4E+05
6/13	0.59	3.3	20	60	10.5	<0.1	TNTC	25.5	22	21	2.6E+05
6/23	0.11	13.5	23	35	7.0	<0.1	TNTC	No	-	-	-
7/18	1.83	0.3	20	36	NR	NR	NR	69.1	19	19	1.6E+05
8/15	0.62	9.3	13	39	NR	NR	NR	No	-	-	-
8/27	0.77	No	-	-	-	-	-	2.1	23	22	2.9E+05
9/8	0.24	3.9	7	25	NR	NR	NR	21.6	21	20	2.2E+05
9/18	1.27	No	-	-	-	-	-	42.3	20	21	2.0E+05
9/28	1.32	18.8	14	23	NR	Trace	NR	25.3	22	21	2.5E+05
10/29	0.05 ⁽²⁾	12.4*	32	40	NR	NR	NR	No	-	-	-
10/30	0.00 ⁽²⁾	0.01*	75	15	NR	NR	NR	No	-	-	-
12/18	0.76	17.4*	44	41	5.0	Trace	TNTC	7.8	21	21	2.3E+05
12/21	0.85	11.1*	46	60	NR	NR	NR	18.0	21	20	2.1E+05
12/27	0.92	31.8*	64	35	7.3	Trace	TNTC	2.8	22	21	2.6E+05
Count⁽³⁾	-	14	-	-	-	-	-	14⁽³⁾	-	-	-
Mean	-	-	29	35	6	<0.1	TNTC	-	22	21	2.4E+05
Total	-	150	-	-	-	-	-	324	-	-	-
⁽¹⁾ Rain-event totals per EPA SYNOP with 4-hr inter-event time and 0 min. rain, based on NOAA LaGuardia level III hourly data, as used for all model calculations. Rain values shown for 9/8 and 9/18 do not include rain from earlier storms on those days. ⁽²⁾ Hurricane Sandy: NOAA level III daily rainfall totals (10/29 0.54 in and 10/30 0.05 in) cited as more reliable than hourly values. ⁽³⁾ Counts reflect number of SYNOP storms with tank overflow. On 9/8, model calculated overflow during 2 storms, observed during 1. ⁽⁴⁾ Per monthly monitoring reports, based on trend analysis of measured water-surface elevations within the tank and hydraulic calculations. "No" means no overflow was observed during this storm. "*" means DEP indicated value is an estimate. "NR" = no data reported. Sampling not required when facility not manned. "TNTC"= Too Numerous to Count.											

**Table 3-7. Flushing Bay CSO Retention Facility
Collected Screenings, 2012**

Month	Collected Screenings (cubic yards)
January	0
February	0
March	0
April	26
May	52
June	52
July	86
August	78
September	78
October	26
November	0
December	0
Annual Total	424
Average per Month	30 (all months) (60 non-zero months)

InfoWorks Modeling

Estimates of tank overflow pollutant loads of effluent BOD₅, TSS and fecal coliform were developed using the methodology developed during the CSO Long-Term Control Plan (LTCP) project. Effluent pollutant concentrations were estimated by assigning typical sanitary and stormwater concentrations to the corresponding sanitary and stormwater portions of the overflow (as estimated by the InfoWorks model). The concentration of the sanitary portion of the overflow is 140 mg/L for BOD₅, 130 mg/L for TSS, and 4,000,000/100 mL for fecal coliform. The concentration of the stormwater portion of the overflow is 15 mg/L for BOD₅, 15 mg/L for TSS, and 35,000/100 mL for fecal coliform. As shown in Table 3-6 (above), model-calculated concentrations for BOD₅ (22 mg/L) compare favorably with monitored concentrations (29 mg/L), while model-calculated TSS concentrations (21 mg/L) are somewhat lower than monitored concentrations (35 mg/L). It should be noted that these model-calculated concentrations were developed for comparison purposes only; the water quality model of Flushing Bay (as described in Section 2 herein) utilizes dissolved and particulate carbon instead of BOD₅ and TSS to calculate dissolved oxygen.

3.2.3 Flushing Bay CSO Retention Facility - Impacts

The impact of the Flushing Bay CSO Retention Facility on CSO discharges from outfall TI-010 was evaluated using InfoWorks model results for two scenarios: the current “with-tank”

condition and a hypothetical “without-tank” condition, identical to the “with-tank” condition except that the facility itself (including the screens, storage elements, pumpback, overflow weir, etc.) is replaced with a simple conduit to outfall TI-010. Table 3-8 summarizes the total annual discharges from outfall TI-010, including both overflow from the tank itself and the bypasses around the tank, for both the “with-tank” and “without-tank” conditions.

**Table 3-8. Model-Calculated Impact of the
Flushing Bay CSO Retention Facility on Discharges at TI-010, 2012**

Parameter	Discharges from TI-010 ⁽¹⁾		
	Without Tank ⁽²⁾	With Tank	Percent Reduction With Tank
Overflow Events (count)	66	15	77
Volume (MG)	981	385	61
BOD ₅ (lb) ⁽³⁾	173,629	67,407	61
TSS (lb) ⁽³⁾	169,556	65,872	61
Fecal Coliform (cells) ⁽³⁾	6.9 E+15	3.3 E+15	53
⁽¹⁾ Reflects discharges from Tank overflow and bypass at TI-010 outfall to Flushing Creek. ⁽²⁾ Without-tank modeling includes 5.3 MGD average I/I from collection system. I/I concentrations assumed to be zero for pathogens and otherwise same as stormwater. Number of “overflow” events estimated as periods of overflow from tributary regulators. ⁽³⁾ Based on application of InfoWorks-calculated sanitary/stormwater fractions of discharges, with sanitary –sewage concentrations of 140 mg/L BOD ₅ , 130 mg/L TSS, and 4.0E+06 cells/100mL Fecal Coliform, and stormwater concentrations of 15 mg/L BOD ₅ , 15 mg/L TSS, and 3.5E+05 cells/100mL Fecal Coliform. I/I flow considered stormwater except that Fecal Coliform concentration taken as zero.			

As shown in Table 3-8, the results of the modeling analysis indicate that relative to a “without-tank” condition, the Flushing Bay tank reduces CSO events at outfall TI-010 by 77 percent, CSO volume by 61 percent, pollutant discharges by about 61 percent, and fecal coliform by about 53 percent.

In addition to the other water-quality benefits it affords, the Flushing Bay CSO Retention Facility also removes floatables that would otherwise discharge to the receiving water. As shown in Table 3-7, the facility prevented at least 424 cubic yards of floatables from entering Flushing Creek and Flushing Bay in 2012.

3.3 ALLEY CREEK CSO RETENTION FACILITY

3.3.1 Alley Creek CSO Retention Facility Flow/Volume

Data Summary

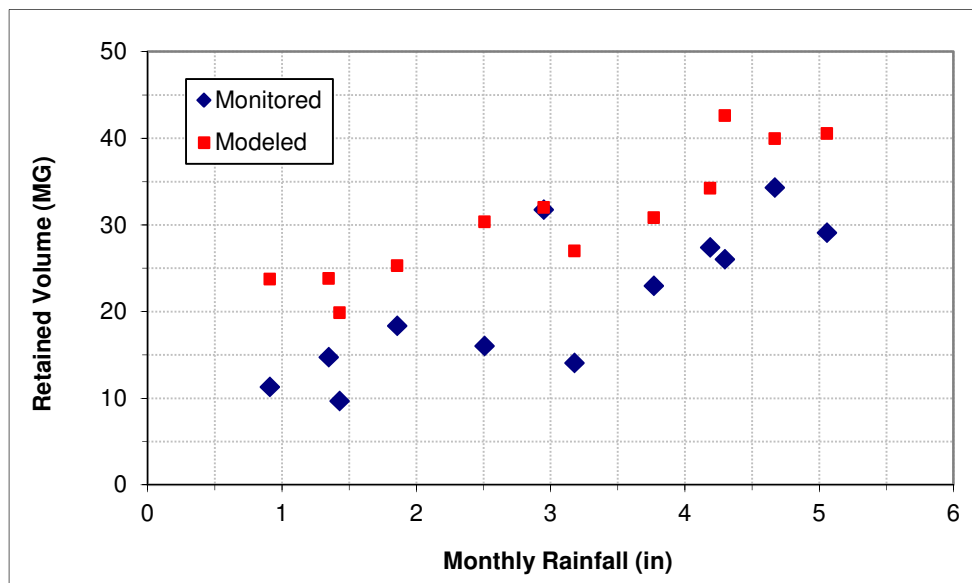
DEP monitors water-surface elevations and pumped volumes over time at the Alley Creek CSO Facility. Based on these measurements and other information, DEP estimates daily inflow and infiltration (I/I), wet-weather retained volume, pumpback volume, and overflow periods and overflow volumes. DEP reports these daily estimates to NYSDEC in monthly operation reports (see Appendix J). Tables 3-9 and 3-10 present a summary of the monthly and per-overflow-event estimates, respectively (additional information is provided in Appendix Q). Monthly monitoring data are also summarized graphically on Figures 3-5 (monthly total retained volume pumped back for treatment) and 3-6 (monthly overflow volume).

Analysis¹ of rainfall data recorded at the National Weather Service's LaGuardia Airport (LGA) gauge indicates that 2012 had 125 storms totaling 36.18 inches. Monthly rainfall ranged from 0.91 to 5.06 inches. As summarized in Table 3-5, the Alley Creek tank overflowed during 25 storm events in 2012, meaning that the tank fully captured flow generated during the other 80 percent (100) of the rainfall events in 2012. DEP reported that the tank retained a total of 256 MG of combined sewage for pumpback and treatment at the Tallman Island WWTP.

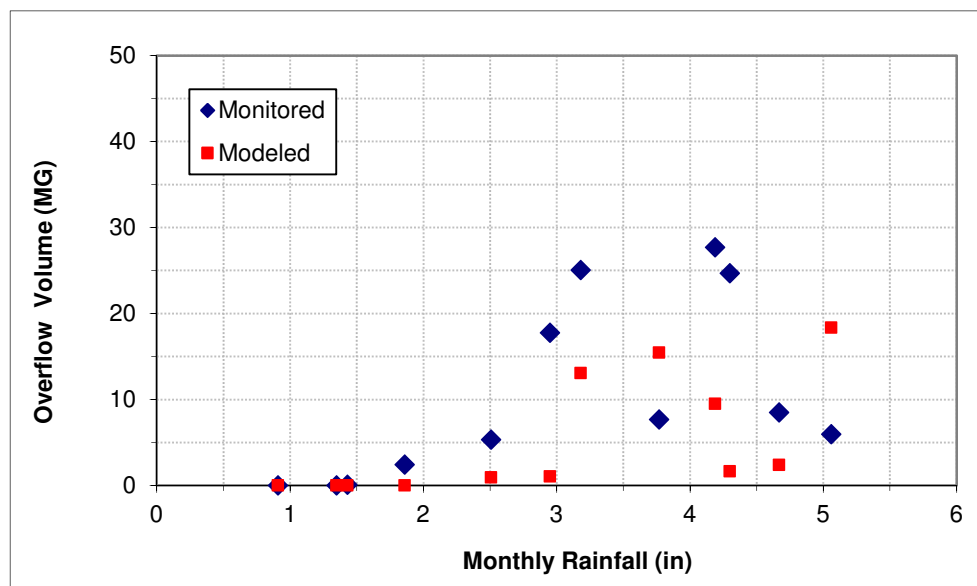
¹ Analyses of rainfall statistics performed using EPA's SYNOP program using minimum inter-event time of 4 hours and minimum storm threshold of zero inches.

**Table 3-9. Alley Creek CSO Retention Facility –
Estimated Monthly Retained Volumes and Overflow Volumes, 2012**

Month	Rain at LGA (in)	Monthly Information Reported to NYSDEC ⁽¹⁾			InfoWorks Model Results		
		Retained Volume (MG)	Overflow Events (Count)	Overflow Volume (MG)	Retained Volume (MG)	Tank Overflow Events (Count)	Tank Overflow Volume (MG)
January	2.51	16	4	5	30	1	1
February	1.43	10	1	0	20	0	0
March	0.91	11	0	0	24	0	0
April	3.18	14	1	25	27	1	13
May	4.67	34	3	9	40	2	2
June	4.19	27	4	28	34	2	9
July	3.77	23	1	8	31	1	15
August	2.95	32	4	18	32	1	1
September	5.06	29	3	6	41	4	18
October	1.86	18	1	2	25	0	0
November	1.35	15	0	0	24	0	0
December	4.30	26	3	25	43	3	2
Totals:	36.18	256	25	125	370	15	62
⁽¹⁾ From monthly operation reports							



**Figure 3-5. Monthly Retained Volume vs. Rainfall,
Alley Creek CSO Retention Facility, 2012**



**Figure 3-6. Monthly Overflow Volume vs. Rainfall,
Alley Creek CSO Retention Facility, 2012**

Inflow and Infiltration (I/I)

Even during dry weather, the Alley Creek tank collects a combination of I/I from the influent sewers and tidal backflow through the facility sluice gates. To quantify the I/I, DEP tracks the water-surface elevations in the tank cells and estimates¹ the overall I/I on a daily and monthly basis. The I/I estimates are reported to NYSDEC in the facility monthly operation reports. In 2012, the average I/I rate was 0.55 MGD, with monthly average values ranging from 0.00 to 0.91 MGD and a highest daily estimate of 4.4 MGD (following a large storm event). The Alley Creek tank is operated such that I/I volumes are pumped back to the WWTP prior to anticipated wet-weather events to minimize the impact on wet-weather capture of combined sewage at the facility.

InfoWorks Modeling

In accordance with the DEC-approved protocol described in *Calculation of Combined Sewer Overflows from Remote Control Facilities*, March 2004, DEP has performed sewer-system modeling for the reporting of CSO facility characteristics as part of the CSO BMP annual reporting effort. This modeling, as noted in the 2004 report, is conducted using the InfoWorks

¹ For the Alley Creek facility, DEP's monthly reporting to DEC indicates that "Estimated I&I Volume on dry weather days= pump back volume + change in the total retained volume (7am-7am)."

hydrologic/hydraulic modeling framework for the Tallman Island and Bowery Bay WWTP service areas (part of the latter can tip flow into the Flushing Bay facility service area during wet weather). These models were initially constructed and calibrated during the Citywide CSO Long-Term Control Planning (LTCP) project (as described in the *Landside Modeling Report – Volume 13, Tallman Island WWTP*, and *Volume 2, Bowery Bay WWTP* (both October 2007)). Subsequent recalibration work was performed in 2012 to refine the way in which pervious areas were identified and their associated hydrology was analyzed (as described in the *InfoWorks Citywide Recalibration Report, Updates to and Recalibration of October 2007 NYC Landside Models*, June 2012). In addition, calibration efforts associated with the Alley Creek LTCP analysis began in early 2013 involving the Tallman Island WWTP service area InfoWorks model. These developments have improved the ability of the modeling framework to more accurately represent the hydrology and hydraulics of the Tallman Island WWTP collection system.

Table 3-9 and Figures 3-5 and 3-6 (above) summarize the InfoWorks model results for the Alley Creek CSO Retention Facility in comparison to the monitoring-based values from DEP’s monthly operation reports. Figure 3-5 shows that the model-calculated and monitoring-based estimates of monthly retained volume follow the same trends, but model-calculated retained volumes are consistently *higher* than the monitoring-based volumes. Similarly, Figure 3-6 shows that for monthly overflow volume, the model-calculated values are typically *lower* than the monitoring-based estimates. Overall, the model-calculated annual retained volume of 370 MG is higher than the monitored value of 256, while the model-calculated number of tank-overflow events (15) and annual overflow volume (62 MG) are lower than monitored values of 25 events and 125 MG, respectively. Evaluations of both the monitoring and modeling will continue to resolve these differences.

Discrepancies between actual overflows and model-predicted overflows are often attributable to the fact that the model results are based on the rainfall at LaGuardia Airport being taken to represent the rainfall over the entire drainage area. In reality, storms move through the area so that the rainfall actually varies over time and space. Since rainfall patterns tend to even out over the area over time, the practice of using the rainfall measured at one nearby location typically provides good agreement with long-term performance for the collection system as a whole; however, model results for any particular storm may vary somewhat from the observed.

Table 3-10 presents the specific overflow events at the Alley Creek tank, both as observed and as calculated with the model using the 2012 rainfall record at LaGuardia Airport. The model predicted overflows during three events for which no overflows were observed: one on May 1, two on September 8, and one September 28. In each of these cases, radar images show that rainfall over the LaGuardia Airport rain gauge exceeded the rainfall over the Alley Creek tank service area, explaining why the model predicted higher wet-weather volumes than

observed. Similarly, there were 14 events for which overflows were observed but for which the model calculated no overflow. Again, inspection of radar precipitation information shows that significantly more rainfall occurred over the Alley Creek tank service area than over the LaGuardia Airport gauge during the January 21, January 22, February 11, June 22, June 25, August 1, August 10, September 4, and October 15 events. Though these rainfall discrepancies could be addressed with storm-specific model runs by using distributed (radar) rainfall in the model, this effort focused on annual calculations for which use of point rainfall information is generally sufficient.

Table 3-10. Alley Creek Retention Facility - Overflow Data and InfoWorks Model Results, 2012

Over-Flow Begin Date	Rain at LGA ⁽¹⁾ (in)	Monthly Information Reported to NYSDEC						InfoWorks Model Calculations			
		Over-flow Vol. ⁽²⁾ (MG)	BOD ₅ (mg/L)	TSS (mg/L)	O&G (mg/L)	Settle-able Solids (mL/L)	F. Coli Geo. Mean (No. /100mL)	Over-flow Vol. (MG)	BOD ₅ (mg/L)	TSS (mg/L)	F. Coli Geo. Mean (No. /100mL)
1/12	1.04	4.5	NR	NR	NR	NR	NR	0.9	15	15	0.5E+05
1/21	0.30	0.1	NR	NR	NR	NR	NR	No	-	-	-
1/22	0.00	0.01	NR	NR	NR	NR	NR	No	-	-	-
1/27	0.39	0.7	NR	NR	NR	NR	NR	No	-	-	-
2/11	0.07	0.1	NR	NR	NR	NR	NR	No	-	-	-
4/22	2.11	25.0	NR	NR	NR	NR	NR	13	17	17	1.0E+05
5/01	0.73	No	-	-	-	-	-	0.02	17	17	1.0E+05
5/04	0.26	1.4	NR	NR	NR	NR	NR	No	-	-	-
5/15	0.46	0.1	NR	NR	NR	NR	NR	No	-	-	-
5/21	1.24	7.0	NR	NR	NR	NR	NR	2.3	17	17	0.9E+05
6/02	1.11	3.9	NR	NR	NR	NR	NR	4.1	17	17	1.0E+05
6/12	1.46	9.7	NR	NR	NR	NR	NR	5.4	16	16	0.8E+05
6/22	0.67	8.4	NR	NR	NR	NR	NR	No	-	-	-
6/25	0.23	5.7	NR	NR	NR	NR	NR	No	-	-	-
7/18	1.83	7.6	NR	NR	NR	NR	NR	15.4	16	16	0.8E+05
8/01	0.39	6.9	NR	NR	NR	NR	NR	No	-	-	-
8/10	0.31	7.1	NR	NR	NR	NR	NR	No	-	-	-
8/15	0.62	2.3	NR	NR	NR	NR	NR	No	-	-	-
8/27	0.77	1.5	NR	NR	NR	NR	NR	1.0	17	17	1.0E+05
9/04	0.13	0.5	NR	NR	NR	NR	NR	No	-	-	-
9/05	0.46	1.5	NR	NR	NR	NR	NR	No	-	-	-
9/08	0.94	No	-	-	-	-	-	3.6	17	17	0.9E+05
9/08	0.24	No	-	-	-	-	-	0.6	17	17	0.9E+05
9/18	1.27	3.9	NR	NR	NR	NR	NR	8.6	16	16	0.7E+05
9/28	1.32	No	-	-	-	-	-	5.5	17	16	0.9E+05
10/15	0.28	2.4	NR	NR	NR	NR	NR	No	-	-	-
12/18	0.76	1.5	NR	NR	NR	NR	NR	0.9	16	16	0.7E+05
12/21	0.85	7.3	NR	NR	NR	NR	NR	0.4	16	16	0.7E+05
12/26	0.92	15.9	NR	NR	NR	NR	NR	0.3	16	16	0.5E+05
Count	-	25	-	-	-	-	-	15	-	-	-
Mean⁽⁴⁾	-	-	-	-	-	-	-	-	16	16	0.8E+05
Total	-	125	-	-	-	-	-	62	-	-	-

⁽¹⁾ Rain events per EPA SYNOP (with 4-hr interevent time, 0-in min.) immediately preceding or during tank overflow. Values do not include prior storms, even if earlier the same day.

⁽²⁾ Reported overflows based on trend analysis of measured in-tank water-surface elevations and hydraulic calculations; modeled overflows based on InfoWorks calculations using LGA rain. "No" means no overflow observed/calculated.

⁽³⁾ Annual means provided for comparison purposes. No monitored data available. Geometric mean shown for bacteria.

NR = not reported (sampling not required when facility not manned). T.N.T.C. = too numerous to count.

3.3.2 Alley Creek CSO Retention Facility Effluent Quality

Data Summary

Overflow effluent quality was not measured at the Alley Creek CSO Retention Facility during any overflow events in 2012. Screenings volumes collected from the tank during dewatering were not recorded. Tables 3-10 and 3-11 show “NR” indicating “not reported” for these parameters.

InfoWorks Modeling

Estimates of tank overflow pollutant loads of effluent BOD₅, TSS and fecal coliform were developed using the methodology developed during the CSO Long-Term Control Plan (LTCP) project. Effluent pollutant concentrations were estimated by assigning typical sanitary and stormwater concentrations to the corresponding sanitary and stormwater portions of the overflow (as estimated by the InfoWorks model). The concentration of the sanitary portion of the overflow is 140 mg/L for BOD₅, 130 mg/L for TSS, and 4,000,000 cells/100 mL for fecal coliform. The concentration of the stormwater portion of the overflow is 15 mg/L for BOD₅, 15 mg/L for TSS, and 35,000 cells/100 mL for fecal coliform. As shown in Table 3-10 (above), model-calculated concentrations for BOD₅, TSS, and fecal coliforms are 17 mg/L, 16 mg/L and 80,000 cells/100mL, respectively. It should be noted that these model-calculated concentrations were developed for comparison purposes only; the water quality model of Alley Creek (as described in Section 2 herein) utilizes dissolved and particulate carbon instead of BOD₅ and TSS to calculate dissolved oxygen.

3.3.3 Alley Creek CSO Retention Facility Impacts

The InfoWorks model and representative concentrations were used to estimate the annual CSO discharges to the Alley Creek waterbody with respect to overflow volume and associated loadings of fecal coliform, BOD₅, and TSS for two scenarios: the current “with tank” condition and a hypothetical “without tank” condition. As shown in Table 3-12, the results of the modeling analysis indicate that, relative to the “without-tank” condition, the Alley Creek tank reduces occurrences of CSOs to the Alley Creek waterbody by 65 percent, discharge volumes by 73 percent, pollutant discharges by 85 percent, and pathogen discharges by about 69 percent.

In addition to its other water-quality benefits, the retention facility also removes floatables that would otherwise discharge to the receiving water. Because screenings volumes were not recorded, no measured estimate of floatables removal is available.

**Table 3-11. Alley Creek CSO Retention Facility
Collected Screenings, 2012**

Month	Collected Screenings (cubic yards)
Jan	NR
Feb	NR
Mar	NR
Apr	NR
May	NR
June	NR
July	NR
Aug	NR
Sep	NR
Oct	NR
Nov	NR
Dec	NR
Annual Total	NR
Average per Month	NR

**Table 3-12. Model-Calculated Impact of the Alley Creek CSO
Retention Facility on Discharges to Alley Creek, 2012**

Parameter	Discharges to Alley Creek (from TI-025 and TI-008 only)		
	Without Tank	With Tank	Percent Reduction With Tank
Overflow Events (count) ⁽¹⁾	43	15	65
Volume (MG) ⁽²⁾	227	62	73
BOD ₅ (lb) ⁽³⁾	56,501	8,620	85
TSS (lb) ⁽³⁾	56,307	8,554	85
Fecal Coliform (cells) ⁽³⁾	6.5E+14	2.0E+14	69
⁽¹⁾ Event counts reflect number of storms during which overflows occur from tank or, in without-tank case, from tributary regulators. ⁽²⁾ Does not include Oakland Lake outlet flows routed to TI-008. ⁽³⁾ Based on application of InfoWorks-calculated sanitary/stormwater fractions of discharges, with sanitary –sewage concentrations of 140 mg/L BOD ₅ , 130 mg/L TSS, and 4.0E+06 cells/100mL Fecal Coliform, and stormwater concentrations of 15 mg/L BOD ₅ , 15 mg/L TSS, and 3.5E+05 cells/100mL Fecal Coliform. I/I flow of 0.56 MGD considered stormwater except that Fecal Coliform concentration taken as zero.			

3.4 PAERDEGAT BASIN CSO RETENTION FACILITY

3.4.1 Paerdegat Basin CSO Retention Facility Flow/Volume

Data Summary

DEP monitors time-varying water-surface elevations and pumpback values at the Paerdegat Basin CSO Retention Facility wet well to estimate I/I volumes, stored volumes, total retained volumes, and overflow volumes over time. DEP reports the observed overflow periods and calculated overflow volumes, I/I volumes, pumpback volumes, and gravity-drained volumes on a daily basis in monthly operation reports submitted to NYSDEC (see Appendix J). Tables 3-13 and 3-14 present a summary of the monthly and per-overflow-event estimates provided to NYSDEC, respectively. Appendix Q summarizes results for storm events in 2012.

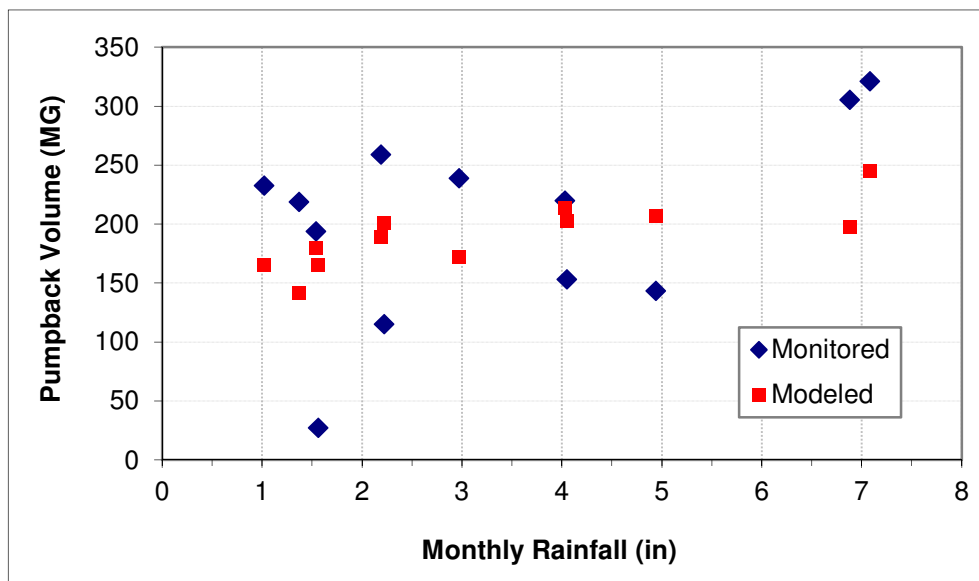
Analysis¹ of rainfall data recorded at the National Weather Service's JFK Airport gauge indicates 2012 had a total of 39.85 inches of rain with 127 storms. Monthly rainfall in 2012 ranged from 1.02 to 7.08 inches in March and May, respectively.

Table 3-13 summarizes monthly rainfall, monthly volumes pumped back to the Coney Island WWTP for treatment, monthly count of overflow events, and monthly overflow volumes based on observations and measurements at the Paerdegat Basin CSO Retention Facility. Overall, in 2012 a total of about 2,429 MG of combined sewage was pumped back for treatment, and another estimated 614 MG gravity drained to the WWTP (based on maximum water elevations and physical geometry of the infrastructure), for a total annual retained volume of about 3,046 MG. During the same period, about 1,208 MG of overflow was discharged to Paerdegat Basin over 12 events (no discharge estimate is available for Hurricane Sandy, when a possible overflow occurred, but may have been associated with extreme high tides rather than rainfall; no volume measurements are available due to equipment failure.). As shown in Table 3-13 and graphically on Figure 3-7, the monthly pumpback volumes were generally around 200 MG, although the monthly rainfall pattern can affect the pumpback volume, and volumes drained to the WWTP by gravity are not included in the pumpback figures. Overflow volumes (see Table 3-13 and Figure 3-8) show a stronger correlation with monthly rainfall, although monthly rainfall can also significantly affect the volume. For example, January and October both had rainfall of about 2.2 inches, but observed pumpback volumes during these months varied by a factor of 2 (259 and 115 MG, respectively), and overflow volumes were 200 MG in January but around zero in October (assuming that the overflow during Hurricane Sandy was relatively minor, which is not unreasonable given the relatively low rainfall amount).

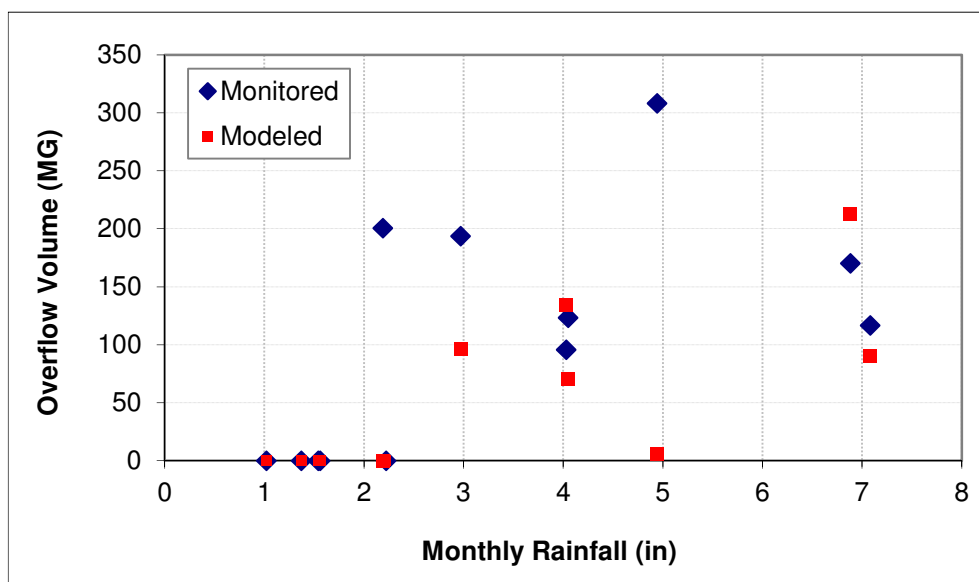
¹ Developed using EPA SYNOP with 4-hr minimum inter-event time and zero minimum rainfall threshold.

**Table 3-13. Paerdegat Basin CSO Retention Facility –
Estimated Monthly Pumpback Volumes and Overflow Volumes, 2012**

Month	Rain at LGA (in)	Monthly Information Reported to NYSDEC			InfoWorks Modeled Results		
		Pump-back Volume ⁽¹⁾ (MG)	Tank Overflow Events (Count)	Tank Overflow Volume (MG)	Pump-back Volume ⁽¹⁾ (MG)	Tank Overflow Events (Count)	Tank Overflow Volume (MG)
January	2.19	259	1	200	189	0	0
February	1.37	219	0	0	142	0	0
March	1.02	233	0	0	165	0	0
April	2.97	239	1	194	172	1	96
May	7.08	321	2	117	245	3	90
June	6.88	306	3	170	198	3	213
July	1.54	194	0	0	180	0	0
August	4.03	220	2	96	214	3	134
September	4.05	153	2	123	203	1	71
October	2.22	115 ⁽²⁾	1 ⁽²⁾	0 ⁽²⁾	201	0	0
November	1.56	27 ⁽²⁾	0 ⁽²⁾	0 ⁽²⁾	166	0	0
December	4.94	143	1	197	207	1	6
Totals:	39.85	2,429	13	1,208	2,282	12	610
<p>(1) Represents combined sewage and I/I that is pumped back to the Coney Island WWTP for treatment. Values not include gravity drained flow, reported to be 614 MG in 2012 per monthly operation reports.</p> <p>(2) Data collection from October 22 to November 19 was compromised due to technical failures associated with Hurricane Sandy. Monthly operation reports note an overflow between 10/29 and 11/2 which is counted herein; however, volumes from this period were not recorded and are not included herein.</p>							



**Figure 3-7. Monthly Retained Volume vs. Rainfall,
Paerdegat Basin CSO Retention Facility, 2012**



**Figure 3-8. Monthly Overflow Volume vs. Rainfall,
Paerdegat Basin CSO Retention Facility, 2012**

Inflow and Infiltration (I/I)

Even during dry weather, the Paerdegat Basin CSO Retention Facility accumulates flow due to inflow and infiltration (I/I) from the upstream collection system. DEP estimates the I/I by tracking the tank pumpback during dry-weather periods¹. Results are included in the monthly facility operation reports submitted to the NYSDEC. In 2012, the average I/I rate was 4.6 MGD, with monthly average values ranging from 0.8 to 7.2 MGD, and daily estimates as high as 51 MGD (which occurred the day after a rainfall event). I/I volumes are pumped from the tank to maximize the storage available for wet-weather events.

InfoWorks Modeling

In accordance with the DEC-approved protocol described in *Calculation of Combined Sewer Overflows from Remote Control Facilities*, March 2004, DEP has performed sewer-system modeling for the reporting of CSO facility characteristics as part of the CSO BMP annual reporting effort. This modeling, as noted in the 2004 report, is conducted using the InfoWorks hydrologic/hydraulic modeling framework. Ongoing recalibration work has been performed as described most recently in the *InfoWorks Citywide Recalibration Report, Updates to and Recalibration of October 2007 NYC Landside Models*, June 2012). As additional information is collected as part of the post-construction monitoring process, future recalibration efforts will help to ensure that the model accurately represents the hydraulics of the new system.

The number of overflow events and the associated overflow volume during each event of 2012 were estimated using the latest available InfoWorks models of the Coney Island and Owls Head WWTP service areas (part of the latter can tip flow into the Paerdegat Basin CSO Retention facility drainage area). Table 3-13 (above) presents the model-calculated monthly and annual-total retained volume, number of overflow events, and overflow volume.

As shown, the model-calculated annual retained volume of 2,282 MG compares well with the monitoring-based value of 2,429 MG, but the monitoring-based values are missing some daily values between July and November. Overall, the model calculated 12 overflow events which compares well to the 12 monitored overflow events (not counting Hurricane Sandy, which may have appeared to be an overflow event based on extremely high tidal surge rather than based on rainfall). However, model-calculated overflow volumes are generally lower than the monitoring-based values, with annual totals of 610 MG versus 1,208, respectively.

¹ DEP estimates daily dry-weather I/I as the pump back volume plus the change in the total retained volume from 12am to 12am. On wet-weather days I/I is the monthly average of all pump back volumes for all dry-weather block periods for the month.

Table 3-14 presents storm-specific results for events for which overflows were observed or calculated using the InfoWorks model. Discrepancies between the observed and model-calculated overflow results are explained below. Because the actual rainfall patterns over the drainage area of the Paerdegat Basin facility may differ from those measured at JFK Airport, the modeling results (which are based on rainfall measured at JFK Airport) may differ somewhat from those observed.

The model calculated that overflows occurred during 3 storms for which no overflows had been reported (May 1, May 9, and August 10). Inspection of radar rainfall information during each of these storms shows that more rain fell at JFK Airport than over the tank drainage area, which explains why the model (which is based on rainfall at JFK Airport) calculated an overflow but no overflow was observed. There were also 4 storms (January 11, May 24, September 18, and October 29) during which overflows were reported, but for which the model did not calculate an overflow. Inspection of radar rainfall information for these storms shows that more rain fell over the tank drainage area than at JFK Airport, which explains why the model did not calculate a tank overflow during these storms. In addition, the October 29/30 event was associated with high tidal conditions rather than rainfall.

3.4.2 Paerdegat CSO Retention Facility – Effluent Quality

Data Summary

Overflow effluent quality for 2012 is summarized in Table 3-14 and in Appendix Q. At least some effluent quality was measured during 8 of the 13 observed overflow events. Observed BOD₅ concentrations typically ranged from 23 to 126 mg/L and averaged about 60 mg/L for the year, while TSS concentrations ranged from 30 to 112 mg/L and averaged about 58 mg/L. Two oil and grease (O&G) measurements averaged about 11 mg/L. No settleable solids measurements were recorded. Disinfection of tank overflows is not performed, and the two fecal coliform measurements averaged about 1,100,000 cells/100mL.

In addition to the water-quality constituents mentioned above, screenings volumes removed from the tank are also tracked and reported monthly to NYSDEC. Table 3-15 summarizes the monthly screenings volumes and indicates the monthly average (82 cubic yards) and annual total (986 cubic yards) screenings volume collected in 2012.

Table 3-14. Paerdegat Basin Tank Overflow Event Data and Model Comparison, 2012

Event Begin Date	Rain at JFK ⁽¹⁾ (in)	Monthly Information Reported to NYSDEC						InfoWorks Model Calculations			
		Over-flow Volume (MG)	BOD ₅ (mg/L)	TSS (mg/L)	Oil & Grease (mg/L)	Settle-able Solids (mg/L)	F. Coli Geo. Mean (No. /100mL)	Over-flow Volume (MG)	BOD ₅ (mg/L)	TSS (mg/L)	F. Coli Geo. Mean (No. /100mL)
1/11	1.02	200	NR	NR	NR	NR	NR	No	-	-	-
4/22	2.39	194	26	37	13	NR	8.1E+05	96	34	33	6.4E+05
5/01	0.94	No	-	-	-	-	-	1	32	31	5.9E+05
5/09	1.21	No	-	-	-	-	-	20	44	42	9.6E+05
5/21	1.92	108	23	48	NR	NR	NR	69	25	24	3.5E+05
5/24	0.40	9	NR	NR	NR	NR	NR	No	-	-	-
6/02	1.26	9	126	68	NR	NR	NR	29	34	33	6.4E+05
6/13	2.45	149	42	30	NR	NR	NR	103	32	30	5.7E+05
6/25	1.67	12	58	112	9.7	NR	13.0E+05	81	22	22	2.7E+05
8/10	2.12	No	-	-	-	-	-	134	22	22	2.6E+05
8/15	0.44	83	NR	NR	NR	NR	NR	0.04	19	19	1.7E+05
8/27	0.52	12	NR	NR	NR	NR	NR	0.05	19	19	1.7E+05
9/08	0.29	66	NR	NR	NR	NR	NR	71	26	25	3.8E+05
9/18	1.59	57	64	80	NR	NR	NR	No	-	-	-
10/29	0.51	NR	NR	38	NR	NR	NR	No	-	-	-
12/26	1.48	308	308	54	NR	NR	NR	6	52	49	12.2E+05
Count	-	13			-	-	-	12			
Mean⁽²⁾	-	-	60	58	11	-	10.6+E05	-	32	31	5.9E+05
Total	-	1,208	-	-	-	-	-	610	-	-	-

(1) Rainfall reported at JFK Airport.
(2) Means represent average for events with total volume of at least 1.0 MG. Fecal coliforms are geometric means if more than 2 events.
"NR" = No reported data. "No" = no overflow observed ,or no overflow calculated with model given JFK rainfall.

**Table 3-15. Paerdegat Basin CSO Retention Facility
Collected Screenings, 2012**

Month	Collected Screenings (cubic yards)
January	108
February	90
March	54
April	32
May	126
June	154
July	34
August	168
September	82
October	80
November	32
December	26
Annual Total	986
Average per Month	82

InfoWorks Modeling

Estimates of tank overflow pollutant loads of effluent BOD₅, TSS and fecal coliform were developed using the methodology developed during the CSO Long-Term Control Plan (LTCP) project. Effluent pollutant concentrations were estimated by assigning typical sanitary and stormwater concentrations to the corresponding sanitary and stormwater portions of the overflow (as estimated by the InfoWorks model). The concentration of the sanitary portion of the overflow is 140 mg/L for BOD₅, 130 mg/L for TSS, and 4,000,000 cells/100 mL for fecal coliform. The concentration of the stormwater portion of the overflow is 15 mg/L for BOD₅, 15 mg/L for TSS, and 35,000 cells/100 mL for fecal coliform. As shown in Table 3-14, the resulting concentration estimates are within the range of—but generally lower than—the observed values. It should be noted that these model-calculated concentrations were developed for comparison purposes only; the water quality model of Paerdegat Basin (as described in Section 2) utilizes dissolved and particulate carbon forms rather than BOD₅ and TSS to calculate impacts on dissolved oxygen.

3.4.3 Paerdegat CSO Retention Facility Impacts

The impact of the Paerdegat Basin CSO Retention Facility on CSO discharges was evaluated using InfoWorks model results for two scenarios: the current “with-tank” condition and a hypothetical “without-tank” condition, identical to the “pre-tank” condition. Table 3-16 summarizes the total annual CSO discharges to Paerdegat Basin for both the “without-tank” and “with tank” conditions.

Table 3-16. Model-Calculated Impact of the Paerdegat Basin CSO Retention Facility on Discharges to Paerdegat Basin, 2012

Parameter	Discharges to Paerdegat Basin ⁽¹⁾		
	Without Tank	With Tank	Percent Reduction With Tank
Overflow Events (count) ⁽²⁾	93	12	87
Volume (MG)	1,326	610	54
BOD ₅ (lb) ⁽³⁾	331,269	142,762	57
TSS (lb) ⁽³⁾	318,045	137,451	57
Fecal Coliform (cells) ⁽³⁾	25.5E+15	10.4E+15	59
⁽¹⁾ Includes discharges from CI-004, CI-005, CI-006, and tank overflow. ⁽²⁾ Event counts reflect number of storms during which an overflow occurs from the tank or, in the without-tank condition, from tributary regulators. ⁽³⁾ Based on application of InfoWorks-calculated sanitary/stormwater fractions of discharges, with sanitary –sewage concentrations of 140 mg/L BOD ₅ , 130 mg/L TSS, and 4.0E+06 cells/100mL Fecal Coliform, and stormwater concentrations of 15 mg/L BOD ₅ , 15 mg/L TSS, and 3.5E+05 cells/100mL Fecal Coliform.			

As shown in Table 3-16, the results of the modeling analysis indicate that relative to a “without tank” condition, the Paerdegat Basin tank reduces CSO events by 87 percent, CSO volume by 54 percent, pollutant discharges by about 57 percent, and fecal coliform by about 59 percent.

In addition to the other water quality benefits it affords, the Paerdegat Basin CSO Retention Facility also removes floatables that would otherwise discharge to the receiving water. As shown in Table 3-15, the facility prevented at least 986 cubic yards of floatables from entering Paerdegat Basin in 2012.

4.0 ASSESSMENT OF PERFORMANCE CRITERIA

4.1 SPRING CREEK CSO RETENTION FACILITY

4.1.1 Spring Creek CSO Retention Facility – Design Criteria

The NYSDEC-approved wet-weather operating plan (WWOP) for the Spring Creek CSO Retention Facility¹ states the following: *“The function of the Spring Creek [CSO Retention Facility] is to capture the combined sewer overflow from tributary drainage areas in Brooklyn and Queens. [...] The facility] was placed into service in the early 1970s and has a minimum storage capacity of approximately 19.3 MG; approximately 9.9 MG in basin storage and approximately 9.4 MG in influent barrel storage. [...] The [CSO facility] does not provide treatment of combined sewage via controlled process as in a typical wastewater pollution control facility. The CSO facility provides floatable control, high rate settling and storage of CSO flows. Disinfection of the CSO flows at the facility will not be provided.”*

Therefore, appropriate performance metrics for the Spring Creek CSO Retention Facility are as follows:

1. CSO Storage: Given sufficient wet-weather flow, did the facility fill to capacity (indicating that storage of 19.3 MG has been achieved)?
2. Floatables Control: Did the facility remove combined-sewage floatables that would otherwise discharge to the waterbody?

4.1.2 Performance Assessment - Spring Creek CSO Retention Facility

The appropriate performance metrics for the Spring Creek CSO Retention Facility are described above. The following is an assessment of the performance metrics for 2012.

CSO Storage

Analysis² of 2012 rainfall measured at JFK Airport indicates that there were 127 rainfall events. According to the 2012 monthly reports submitted to NYSDEC (Appendix R), the Spring Creek CSO Retention Facility fully captured combined sewage generated during 119 of these storm events, or about 94 percent of the storms in 2012. The Spring Creek tank retained its full capacity of 19.3 MG or more during 10 storm events, 8 of which exceeded the facility's capacity

¹ 26th Ward Water Pollution Control Plant, Wet Weather Operating Plan, August 2009 (approved September 2009).

² Statistic developed using EPA's SYNOP program with 4-hour inter-event time and 0 inch minimum storm threshold.

and produced overflows. (Retained volumes of greater than the facility's 19.3 MG capacity were achieved when lulls in the rainfall patterns allowed stored volumes to gravity flow back to the 26th Ward WWTP, freeing up storage capacity that was subsequently utilized when rainfall intensified later during the same storm.) These values demonstrate that, in 2012, the facility satisfied the hydraulic-capture performance metric of filling to capacity given sufficient rainfall.

As shown in Table 4-1, the tank retained about 256 MG during these 10 storm events. An additional 247 MG was retained during other rainfall events that did not fully fill the tank's storage capacity, so that the total annual retained volume reported in 2012 was 503 MG (see Table 3-1). As described in Section 3, an InfoWorks modeling analysis indicated that the tank reduced CSO volume to Spring Creek by 64 percent versus the no-tank condition (Table 3-4).

**Table 4-1. Storm Events Utilizing Full Capacity of
Spring Creek CSO Retention Facility, 2012**

Event No.	Storm Event Statistics ⁽¹⁾ at JFK Airport					Retained Volume (MG) ⁽³⁾	Tank Overflow (Y/N) ⁽⁴⁾
	Start		End		Rainfall (inch)		
	Mo/Da	Hr:Mn	Mo/Da	Hr:Mn			
1	4/22	12:00	4/23	06:00	2.39	31.7	Y
2	5/21	07:00	5/22	09:00	1.92	25.4	Y
3	6/01	08:00	6/02	03:00	1.26	23.9	Y
4	6/12	12:00	6/13	16:00	2.45	28.0	Y
5	6/22	14:00	6/23	05:00	0.84	26.5	Y
6	8/15	15:00	8/15	21:00	0.44 ⁽²⁾	25.3	Y
7	8/27	13:00	8/27	15:00	0.52	20.0	N
8	9/08	18:00	9/09	00:00	0.29 ⁽²⁾	27.5	Y
9	9/18	20:00	9/19	04:00	1.59	21.1	N
10	10/29	07:00	10/29	20:00	0.51	26.9	Y
Sum						256	
⁽¹⁾ Developed using USEPA SYNOP program with 4-hr inter-event time and 0 minimum rain.							
⁽²⁾ Radar indicates that facility drainage area received rainfall of up to 2.0 inches on 8/15 and up to 1.5 inches on 9/08.							
⁽³⁾ Retained volume based on monthly operation reports.							
⁽⁴⁾ Tank overflow occurrences as reported in monthly operation reports.							

Floatables Control

Combined-sewage floatables that enter the Spring Creek CSO Retention Facility are retained in the tank, which features underflow baffles to prevent the floatables from discharging to the receiving water. The retained floatables are removed via screening prior to pumpback to the 26th Ward WWTP. According to the monthly reports submitted to NYSDEC (Appendix R), and as described above in Section 3.1.3, approximately 490 cubic yards of floatable material was removed from the Spring Creek facility in 2012. This floatable material would otherwise have been discharged to Spring Creek. As a result, the facility satisfies this performance metric.

4.2 FLUSHING BAY CSO RETENTION FACILITY

4.2.1 Flushing Bay CSO Retention Facility – Design Criteria

The approved Flushing Bay Water Quality Facility Plan¹ described how the original design for the Flushing Bay CSO Retention Facility, which featured an offline-only storage capacity of 40 MG, was modified to achieve the equivalent performance using a 43 MG capacity facility featuring 28 MG in offline storage capacity and 15 MG from in-line storage available in the upstream sewers. According to the Facility Plan, offline storage of 40 MG was anticipated to reduce the annual CSO volume from TI-010 by about 58 percent.²

DEP's most recent Wet-Weather Operating Plan (WWOP) for the Flushing Bay CSO Retention Facility describes the facility and its performance objectives as follows³:

"The Flushing Bay CSO Retention Facility is a 43.4 MG storage Facility with flow-through capacity. The Facility is comprised of a 28.4 MG CSO storage tank, and a 15 MG in-line storage component. The Flushing Bay CSO Retention Facility is designed to capture and store the combined sewage that normally overflows to Outfall No. TI-010. [...]"

The Facility is projected to capture approximately 1,114 MG/yr of CSO in a typical year and reduce CSO discharges into Flushing Creek by about 57%. At peak flow, with the storage tank initially empty, a storm with a return period of up to one month can be fully captured in the Flushing Bay CSO Retention Facility. During storms that generate CSOs in excess of the volumetric capacity of the retention Facility, combined sewage will flow through the CSO storage tank and discharge to Flushing Bay through Outfall TI-010. During infrequent, intense storms, portions of the CSOs will overflow the diversion/bypass weirs and bypass the storage tank.

The primary goal of the Flushing Bay CSO Retention Facility is to reduce the frequency and volume of CSOs through Outfall TI-010 into Flushing Bay. With this, the quality of the receiving waters will ultimately be improved by increasing dissolved oxygen (DO) levels, decreasing coliform levels, and decreasing discharges of floatables and settleable solids. The goal of the facility is to maximize storage of rain events and minimize overflows by pumping back early and often so the tanks are emptied prior to the next storm event.

The new influent channels, in-line storage and the CSO storage tank that comprise the Flushing Bay CSO Retention Facility will provide the following pollution control functions:

- *CSO Retention Tank with 28.4 MG of storage capacity.*
- *In-line CSO storage of up to 15 MG in the combined sewers and influent channels upstream of the retention tank.*

¹ *Flushing Bay Water Quality Facility Plan Development – Summary of Facility Plan Development.* Prepared by URS Corp. for New York City Department of Environmental Protection, Bureau of Environmental Engineering, April 2, 2003

² *Figure 2-11, Flushing Bay Water Quality Facility Plan Development – Summary of Facility Plan Development.*

³ *Tallman Island Water Pollution Control Plant, Wet-Weather Operating Plan, August 2009.*

- *Full capture of storm events up to 43.4 MG with subsequent pumping (pumpback) of the retained CSOs to the Flushing Interceptor after storms for conveyance to the TI WWTP where it will be treated.*
- *Screening of debris and floatables from all CSO passing through the Facility.*
- *Cleaning of the tank after each storm upon the completion of pumpback operations. Stored combined sewage will be used for this purpose.*
- *Multiple overflow paths consisting of retention tank overflow weirs, and an influent channel side overflow relief weir to convey peak storm flows to bypass the retention tank and discharge directly to outfall TI-010.”*

Therefore, appropriate performance metrics for the Flushing Bay CSO Retention Facility are as follows:

1. CSO Storage: Does the facility utilize its storage capacity to achieve the following:
 - a. Capture storm events sized up to the “one-month” return period (events with approximately 1.0 inches total rainfall), subject to an initially empty tank and the peak-flow limit of the facility (1,400 MGD)?
 - b. Capture approximately 1,114 MG/yr of CSO in a typical year?
 - c. Reduce CSO discharges from Outfall TI-010 by about 57% in a typical year?
2. Water Quality: Does the facility improve the quality of the receiving waters by:
 - a. Decreasing levels of coliform bacteria?
 - b. Increasing levels of dissolved oxygen?
 - c. Decreasing discharges of total suspended solids?
 - d. Decreasing discharges of floatables?

4.2.2 Performance Assessment - Flushing Bay CSO Retention Facility

The appropriate performance metrics for the Flushing Bay CSO Retention Facility are described above. The following is an assessment of the performance metrics for 2012.

CSO Storage

Analysis¹ of the 2012 rainfall records at LaGuardia Airport indicates that there were 125 rainfall events, of which 9 had more than 1.0 inch of rain (the approximate design storm for the Flushing Bay CSO Retention Facility.) Based on this information and the operational records in

¹ Statistic developed using EPA’s SYNOPSIS program with 4-hour inter-event time and zero minimum storm threshold.

the monthly operation reports, the facility fully captured combined sewage generated in 111 of 125 storms, or 89 percent of all storms in 2012.

Table 4-2 lists the start and end times of each of the 14 overflow events in 2012, along with the corresponding rainfall characteristics as measured at LaGuardia Airport. Rainfall at LaGuardia Airport exceeded the 1.0-inch design capacity of the facility during 7 of these overflow events, and inspection of radar information indicates that an inch or more of rain may have fallen *over the facility drainage area* during another 4 events (June 23, August 15, December 21, and December 27th). The October 30 and December 18 storms began less than 24 hours after the end of the prior rain event, such that the tank could not be fully dewatered, and the October 29 overflow was associated with Hurricane Sandy, which involved tidal surges and inflows in addition to rainfall. Therefore, with the exception of Hurricane Sandy, the facility captured all combined sewage generated in the facility service area from storms of up to 1.0 inch and preceded by at least 24 hours of dry weather.

Per the 2012 monthly operation reports, DEP estimates that the Flushing Bay CSO Retention Facility retained a total of 2,870 MG, of which approximately 1,666 MG was retained during wet-weather days. This exceeds the targeted annual-average retention of 1,114 MG.

As described in Section 3.2.3 (Table 3-8), modeling analyses indicate that the Flushing Bay CSO Retention Facility reduced CSO volume in 2012 approximately 61 percent relative to the “without-tank” condition. This reduction exceeds the targeted annual-average CSO volume reduction of 57 percent. Overall, the Flushing Bay CSO Retention Facility met the CSO Storage performance metrics in 2012.

Table 4-2. Observed Overflow Events and Hours Since Prior Rain, Flushing Bay CSO Retention Facility, 2012

Overflow Event at Flushing Bay Tank			Rain Event at LaGuardia Airport ⁽¹⁾			Hours Since Prior Rain ⁽³⁾
Overflow No.	Start Mo/Da Hr:Mn	End Mo/Da Hr:Mn	Start Mo/Da Hr:Mn	End Mo/Da Hr:Mn	Rainfall (inch) ⁽²⁾	
1	01/12 11:00	01/13 00:00	01/11 23:00	01/12 14:00	1.04	241
2	04/22 22:00	04/23 14:00	04/22 11:00	04/23 08:00	2.11	9
3	05/21 18:47	05/22 06:10	05/21 09:00	05/22 07:00	1.24	122
4	06/13 02:28	06/13 11:32	06/12 12:00	06/13 04:00	1.46	56
5	06/23 05:23	06/23 14:11	06/22 14:00	06/23 04:00	0.67	217
6	07/18 21:23	07/19 04:16	07/18 15:00	07/18 19:00	1.83	64
7	08/15 20:44	08/16 04:27	08/15 13:00	08/15 21:00	0.62	24
8	09/08 09:00	09/09 03:00	09/08 18:00	09/08 23:00	1.18	68
9	09/28 07:00	09/28 20:30	09/28 03:00	09/28 13:00	1.32	21
10	10/29 20:10	10/30 04:38	10/30 08:00	10/30 12:00	0.58⁽⁴⁾	130
11	10/30 21:59	10/30 22:16	10/30 01:00	10/30 02:00	0.10⁽⁴⁾	13⁽⁴⁾
12	12/18 04:47	12/18 13:35	12/18 17:00	12/18 18:00	0.01	11
13	12/21 10:04	12/21 16:23	12/21 00:00	12/21 11:00	0.85	54
14	12/27 02:00	12/28 03:30	12/26 17:00	12/27 11:00	0.92	34
⁽¹⁾ Statistics calculated using USEPA SYNOP program with 4-hr inter-event time and zero min rainfall. ⁽²⁾ Bold rain events are below 1.0 inch and are therefore expected to be fully captured. ⁽³⁾ Date and time of prior rain event not shown in this table. ⁽⁴⁾ NOAA reports unreliable hourly rainfall during Sandy; volume taken from daily totals, timing from radar.						

Water Quality

As presented in Table 2-7, modeling analyses indicate that operation of the Flushing Bay CSO Retention Facility improved attainment of the fecal coliform monthly standard ($\leq 2,000$ cells/100mL) in 2012. At Flushing Creek station FLC1, the analyses indicate that the tank increased attainment by 17 percent (to 100 percent versus 83 percent without the tank).

Modeling analyses further indicate that operation of the Flushing Bay tank increased dissolved oxygen concentrations in Flushing Creek (FLC1) in 2012. As presented in Table 2-8, calculated attainment of the ≥ 4.0 mg/L criterion improved from May through October to 100, 72, 56, 51, 76, and 99 percent from 98, 15, 28, 2, 18, and 91 percent, respectively.

With respect to total suspended solids, modeling analyses indicate that the tank's capture of CSO reduced loadings by 61 percent versus the no-tank condition, as summarized in Table 3-8. The modeling analyses projected similar reductions of BOD loadings. In both cases, the projected reductions do not account for treatment via settling in the tank.

Combined-sewage flow entering the Flushing Bay CSO Retention Facility passes through automatic bar screens (1.25-inch clear spacing) intended to remove large debris and floatables into screenings hoppers. In addition, the tank cells feature an underflow baffle designed to retain remaining floatables within the tank. Retained floatables are pumped back to the Tallman Island WWTP where they are removed. According to the monthly reports submitted to NYSDEC (Appendix R), and as described above in Section 3.2.2, approximately 424 cubic yards of floatable material was removed from the Flushing Bay facility from April through December 2012. This floatable material would otherwise have been discharged to Flushing Creek. As a result, the facility satisfies this performance metric.

4.3 ALLEY CREEK CSO RETENTION FACILITY

4.3.1 Alley Creek CSO Retention Facility – Design Criteria

The CSO Abatement Facilities Plan for Alley Creek¹ states that water-quality objectives provided the basis of design for the Alley Creek CSO Retention Facility. Specifically, the design objectives were to meet, to the extent feasible and practical, NYSDEC Class I water-quality criteria for dissolved oxygen and for total and fecal coliforms in Alley Creek by reducing the volume of CSOs discharged to Alley Creek. The Facility Plan states that dissolved oxygen represents the primary parameter of concern, as CSO control alone is not cost effective to meet the bacteria criteria. The Facility Plan also lists as a secondary objective, independent of CSO abatement, the alleviation of surcharging and street flooding in the area upstream of outfall TI-008. This report focuses on the first objective.

The Alley Creek Facility Plan states that the Alley Creek CSO Retention Facility will, through its 5 MG storage capacity, capture 100 percent of combined sewage generated by storms up to about 0.46 inches total precipitation. This storage capacity is expected to fully capture combined sewage generated in the facility drainage area from 70 percent of the storms that occur on an annual basis, and to reduce discharges by about 54 percent in terms of annual average CSO volume, 70 percent in terms of TSS loading, and 66 percent in terms of BOD loading, as well as reductions in floatables and pathogens. Under baseline conditions (the modeling period of June through September 1990), modeling analyses indicate that the minimum DO concentrations in the creek will increase by about 1.17 mg/L, to 3.46 mg/L from 2.29 mg/L, and that average DO concentrations in the creek will increase by about 0.33 mg/L, to 5.97 mg/L from 5.64 mg/L.

¹ *East River Combined Sewer Overflow (CSO) Abatement Facilities Plan – Alley Creek, Final Engineering Report, Summary of Facilities Plan Development.* Prepared by URS Corp. for New York City Department of Environmental Protection, Bureau of Environmental Engineering, April 2, 2003

The above discussion of the expected impacts of the Alley Creek CSO Retention Facility are based on design storm calculations and modeling scenarios. However, actual performance and impacts will be affected by actual tides and weather patterns, as well as operational concerns such as the ability to pumpback stored CSO volumes for treatment. DEP's most recent Wet-Weather Operating Plan (WWOP) for the Alley Creek CSO Retention Facility describes the pumpback process as follows¹:

"The Old Douglaston Pumping Station (ODPS) has been modified to accept flow drained from the CSO storage facility. After storms, during dry-weather conditions, when there is available hydraulic capacity in the existing combined sewer system and at the Tallman Island WWTP, the outfall sewer and CSO storage conduit is drained to the wet well of the pumping station. [...] The ODPS has a new capacity of approximately 8.5 MGD. Given the average dry-weather flow for the pumping station drainage area, the pumping station has available capacity, 3.3 MGD, to pump out the Alley Creek CSO Retention Facility in approximately 36 hours. [...] The combined pumping rates from the Alley Creek CSO Retention Facility and the Flushing Bay CSO Retention Facility, during the pumpback sequence are controlled [...] to ensure that the preset flows/levels are not exceeded at the influent to the Tallman Island WWTP or at Regulator No. 9."

Appropriate performance metrics for the Alley Creek CSO Retention Facility are:

1. CSO Storage: Does the facility utilize its storage capacity to achieve the following, given that combined sewage from *prior storm events* has been emptied from the tank:
 - a. Capture all combined sewage generated from the facility service area for storm events sized up to about 0.46 inches?
 - b. Reduce the number of CSO discharges from the facility drainage area to Alley Creek by about 70 percent as an annual average?
 - c. Reduce the average-annual volume of CSO discharged from the facility drainage area to Alley Creek by about 54 percent?
2. CSO Pollutant-Load Reduction: Does the facility achieve pollutant-discharge reductions associated with above reduction of CSO:
 - a. Decrease annual-average discharges of TSS by about 70 percent?
 - b. Decrease annual-average discharges of BOD by about 66 percent?
 - c. Decrease floatables discharges substantially?
3. Water Quality: Does the facility increase DO levels in the receiving waters?

¹ Tallman Island Wastewater Treatment Plan, Wet-Weather Operating Plan, Alley Creek CSO Retention Facility, July 2010.

4.3.2 Performance Assessment – Alley Creek CSO Retention Facility

The appropriate performance metrics for the Alley Creek CSO Retention Facility are described above. The following is an assessment of the performance metrics for 2012.

CSO Storage

Analysis¹ of the 2012 rainfall records at LaGuardia Airport indicates that there were 125 rainfall events, of which 25 were greater than 0.46 inches (the approximate design storm for the Alley Creek CSO Retention Facility). Based on this information and the operational records in the monthly operation reports, the facility fully captured combined sewage generated in 100 of the 125 storms, or 80 percent of all storms in 2012.

Table 4-3 lists the start and end times of each of the 25 observed overflow events in 2012, along with the corresponding rainfall characteristics as measured at LaGuardia Airport. Rainfall at LaGuardia Airport exceeded the 0.46-inch design capacity of the facility during 15 of these overflow events, and inspection of radar information indicates that 0.46 inches or more likely occurred *over the facility drainage area* during another 4 overflow events (January 21, February 11, August 10, and October 15). Another 6 overflow events occurred during storms that began within 36 hours of prior rainfall so that there was insufficient time for the tank to fully dewater, such that the facility was not expected to fully capture those storm events. As a result, the facility met the CSO-storage metrics for each of the 25 observed overflow events in 2012.

As described in Section 3.3, InfoWorks modeling performed for the 2012 period indicates that, compared to the without-tank condition, operation of the Alley Creek CSO Retention Facility reduced CSO discharge volumes by 73 percent, which meets the annual-average target of 54 percent.

¹ Statistic developed using EPA's SYNOP program with 4-hour inter-event time and 0 inch minimum storm threshold.

**Table 4-3. Overflow-Event Timing and Hours Since Prior Storm,
Alley Creek CSO Retention Facility, 2012**

Overflow Event at Alley Creek Tank			Rain Event at LaGuardia Airport ⁽¹⁾			Hours Since Prior Rain ⁽⁴⁾
Overflow No.	Start Mo/Da Hr:Mn	End Mo/Da Hr:Mn	Start Mo/Da Hr:Mn	End Mo/Da Hr:Mn	Rainfall (inch) ⁽²⁾	
1	01/11 07:25	01/11 18:44	01/11 23:00	01/12 14:00	1.04	241
2	01/21 12:17	01/21 22:50	01/21 04:00	01/21 14:00	0.30	83
3	01/22 11:24	01/22 16:05	(3)	(3)	0.00 ⁽³⁾	21
4	01/27 11:32	01/28 07:58	01/27 08:00	01/27 14:00	0.39	7
5	02/11 12:04	02/11 16:15	02/11 04:00	02/11 11:00	0.07 ⁽³⁾	52
6	04/22 19:04	04/23 18:00	04/22 11:00	04/23 08:00	2.11	9
7	05/04 07:00	05/04 13:52	05/04 05:00	05/04 07:00	0.26	25
8	05/15 16:13	05/16 01:20	05/15 11:00	05/15 16:00	0.46	19
9	05/21 10:21	05/22 05:32	05/21 09:00	05/22 07:00	1.24	122
10	06/02 01:32	06/02 08:58	06/02 00:00	06/02 09:00	1.11	73
11	06/12 23:36	06/13 13:44	06/12 12:00	06/13 04:00	1.46	56
12	06/22 15:26	06/23 10:58	06/22 14:00	06/23 04:00	0.67	217
13	06/25 17:07	06/26 01:31	06/25 16:00	06/25 19:00	0.23 ⁽³⁾	6
14	07/18 16:49	07/19 01:10	07/18 15:00	07/18 19:00	1.83	64
15	08/01 11:58	08/01 21:17	08/01 13:00	08/01 16:00	0.14	4
16	08/10 13:00	08/10 21:57	08/10 12:00	08/10 14:00	0.31 ⁽³⁾	104
17	08/15 14:12	08/16 04:23	08/15 13:00	08/15 21:00	0.62	24
18	08/27 13:25	08/27 20:06	08/27 12:00	08/27 14:00	0.77	218
19	09/04 12:14	09/04 20:35	09/04 11:00	09/04 22:00	0.13	9
20	09/05 11:42	09/05 20:44	09/05 09:00	09/05 13:00	0.46	6
21	09/18 22:58	09/19 05:12	09/18 19:00	09/18 23:00	1.27	8
22	10/15 19:07	10/16 02:28	10/15 17:00	10/15 20:00	0.28 ⁽³⁾	128
23	12/18 01:47	12/19 00:17	12/17 22:00	12/18 06:00	0.76	14
24	12/21 07:04	12/22 01:06	12/21 00:00	12/21 11:00	0.85	54
25	12/26 22:09	12/28 07:14	12/26 17:00	12/27 11:00	0.92	34
⁽¹⁾ Statistics generated using EPA SYNOP with 4-hr inter-event time and zero minimum rain threshold. ⁽²⁾ Bold rain events are 0.46 inch or more and are therefore expected to fill or exceed the tank capacity. ⁽³⁾ Radar shows the facility drainage area received up to: 0.75 inches on 1/21; 0.20 inches on 2/11; 1.50 inches on 6/25; 0.75 inches on 8/10; and 0.50 inches on 10/15. ⁽⁴⁾ Bold values reflect insufficient antecedent dry time (less than the 36 hr) required to dewater the tank, subject to available capacity in the collection system and at Tallman Island WWTP. (Date and time of prior rain not shown in this table.)						

CSO Pollutant-Load Reduction

Based upon the InfoWorks modeling analyses described in Section 3.3.3, the operation of the Alley Creek CSO Retention Facility reduced 2012 pollutant loadings of TSS and BOD by an estimated 85 percent versus the without-tank condition. This reduction meets the annual-average target reductions of 70 and 66 percent for TSS and BOD, respectively.

As noted above, the Alley Creek CSO Retention Facility fully captured combined sewage and all associated floatables for 100 of the 125 rainfall events in 2012. Modeling analyses indicate that the tank reduced the volume of discharged CSO by 73 percent in 2012. During the 25 events in 2012 when the tank did overflow, floatables removal at the facility was enhanced by means of an underflow baffle. Retained floatables are removed either at trash racks at the Old Douglastown Pump Station at the influent screens at the Tallman Island WWTP. Overall, the facility satisfied this performance criterion through substantially reducing the discharge of floatables to Alley Creek.

Water Quality

Water-quality monitoring performed in Alley Creek (as described in Section 2.3) indicated some excursions of dissolved-oxygen concentrations below the ≥ 4.0 mg/L criterion at station AC1. Of 25 readings, 19 were more than 4.0 mg/L. These results are consistent with modeling calculations indicating that the Alley Creek CSO Retention Facility increased dissolved oxygen concentrations in Alley Creek (at station AC1) in 2012. As presented in Table 2-12, modeling analyses indicate that the tank improved monthly attainment of the ≥ 4.0 mg/L criterion at station AC1 by as much as 11 percentage points 2012, with improved attainment from May through October of 100, 93, 98, 84, 87, and 100 percent from 98, 81, 93, 73, 77, and 99 percent, respectively without the tank. Model results show that the tank increased calculated minimum monthly dissolved-oxygen values by at least 0.2 mg/L and by as much as more than 1.0 mg/L at station AC1.

Water-quality monitoring in Alley Creek (as described in Section 2.3) indicated that most (15 of 25) station AC1 readings were higher than 2,000 cells/100mL, the monthly geometric mean criterion. As presented in Table 2-10, modeling analyses indicate that the Alley Creek CSO Retention Facility reduced fecal coliform levels in 2012. At Alley Creek station AC1, modeling analyses indicate that the monthly geometric mean values decrease from a range of 585 – 1,368 cells/100mL without the tank to 555 – 1,273 cells/100mL with the tank.

4.4 PAERDEGAT BASIN CSO RETENTION FACILITY

4.4.1 Paerdegat Basin CSO Retention Facility – Design Criteria

The Paerdegat Basin Water Quality Facility Plan¹ describes the Paerdegat Basin CSO Retention Facility as providing 50 MG of storage capacity (including 20 MG in-tank retention, 10 MG in influent channels, and 20 MG in upstream in-line storage) and a peak hydraulic

¹ Paerdegat Basin Water Quality Facility Plan, Modified CSO Facility Planning Report, February 2004.

capacity of 3,000 MGD. The Facility Plan further states, “*During rain events, CSO flows will be routed [...] to the retention tanks, which will fill to the level of the tank effluent weirs. [...] Settleable material will settle to the bottom of each tank and floatables will be captured by the tank baffles. After a storm event, a portion [9 MG] of the CSO stored in the retention tank and influent sewers will drain by gravity back to the Coney Island WWTP interceptor [and the] remaining 21 MG of CSO in the retention tanks will be pumped to the Coney Island WWTP interceptor. Disinfection of tank overflows has not been included.*” With respect to anticipated water-quality benefits, the Facility Plan cited modeling predictions showing that, given implementation of this and other facility plans throughout Jamaica Bay and its tributaries, Paerdegat Basin will on an annual-average basis attain the New York State Class I dissolved-oxygen criterion of never-less-than 4 mg/L greater than 90 percent of the time, which is almost the same level of attainment as complete sewer separation. Modeling projections also show that the basin would attain 100 percent compliance with Class I secondary contact criteria.

Therefore, appropriate performance metrics for the Paerdegat Basin CSO Retention Facility are as follows:

1. CSO Storage: Does the facility capture combined sewage up to its capacity of 50 MG during wet weather?
2. Floatables Control: Did the facility remove combined-sewage floatables that would otherwise discharge to the waterbody?
3. Water Quality, Dissolved Oxygen: Do dissolved oxygen levels within the basin attain the never-less-than 4 mg/L criterion more than 90 percent of the time?
4. Water Quality, Pathogens: Do fecal coliform levels within the basin attain the geometric mean of less than 2,000 cells/100mL?

4.4.2 Performance Assessment – Paerdegat Basin CSO Retention Facility

The appropriate performance metrics for the Paerdegat Basin CSO Retention Facility are described above. The following is an assessment of the performance metrics for 2012.

CSO Storage

Analysis¹ of rainfall measured at JFK Airport indicates that there were 127 rainfall events in 2012. According to the 2012 monthly reports submitted to NYSDEC (Appendix R), the

¹ Statistic developed using EPA’s SYNOP program with 4-hour inter-event time and 0 inch minimum rain.

Paerdegat Basin CSO Retention Facility fully captured combined sewage generated from 114 of these storm events, or about 90 percent of the storms in 2012.

Table 4-4 summarizes the storm events utilizing the full 50 MG capacity of the Paerdegat Basin tank, the retained volume, and whether the tank overflowed for each. As shown, the 50 MG storage capacity of the Paerdegat Basin tank was fully utilized for 20 storm events, of which 14 actually resulted in an overflow. As noted above, the facility fully captured all combined sewage for all other storms during the year. According to the monthly operation reports, the volume of combined sewage retained in the tanks, influent channel and inline storage in upstream sewers totaled 1,991 MG in 2012. As a result, the Paerdegat Basin CSO Retention Facility satisfies the CSO storage performance metric.

Table 4-4. Storm Events Utilizing Full (50 MG) Capacity of Paerdegat Basin CSO Retention Facility, 2012

Event No.	Storm Event Statistics ⁽¹⁾ at JFK Airport					Retained Volume (MG) ⁽⁴⁾	Tank Overflow (Y/N) ⁽⁶⁾
	Start		End		Rainfall (inch)		
	Mo/Da	Hr:Mn	Mo/Da	Hr:Mn			
1	1/11	23:00	1/12	11:00	1.02	62	Y
2	2/29	12:00	3/01	05:00	0.60	50	N
3	4/22	12:00	4/23	06:00	2.39	89	Y
4	5/01	05:00	5/01	09:00	0.94	53	N
5	5/21	07:00	5/22	09:00	1.92	77	Y
6	5/24	11:00	5/24	12:00	0.05 ⁽²⁾	111	Y
7	6/01	20:00	6/02	03:00	1.26	69	Y
8	6/12	12:00	6/13	16:00	2.45	95	Y
9	6/22	14:00	6/23	05:00	0.84	52	N
10	6/25	06:00	6/25	10:00	1.67	76	Y
11	8/10	11:00	8/10	15:00	2.12	64	N
12	8/15	15:00	5/15	21:00	0.44	82	Y
13	8/27	13:00	8/27	15:00	0.52	52	Y
14/15	9/08	11:00	9/09	00:00	0.30 ⁽³⁾	78	Y
16	9/18	20:00	9/19	04:00	1.59	95	Y
17	10/29	07:00	10/29	20:00	0.51	NA	Y
18/19	12/17	22:00	12/18	18:00	0.95 ⁽³⁾	58	N
20	12/26	16:00	12/27	11:00	1.48	48 ⁽⁵⁾	Y
⁽¹⁾ Developed using USEPA SYNOPSIS program with 4-hr inter-event time and 0-in min rain.							
⁽²⁾ Rainfall over facility drainage area substantially higher than at JFK gauge.							
⁽³⁾ Includes rainfall from two storm events occurring within time noted.							
⁽⁴⁾ Retained volume based on monthly operation reports of combined sewage volumes estimated retained in tanks, influent channels and inline storage upstream of regulators.							
⁽⁵⁾ Retained volume includes no estimated inline storage upstream of regulators.							
⁽⁶⁾ Tank overflow occurrence as noted in monthly operation reports.							

Floatables Control

Combined-sewage floatables that enter the Paerdegat Basin CSO Retention Facility are removed via influent bar screens or retained and subsequently removed at the Coney Island WWTP. According to monthly reports submitted to NYSDEC (Appendix R), and as described above in Section 3.2.2, approximately 986 cubic yards of floatable material was removed from the Paerdegat Basin facility in 2012. This floatable material would otherwise have been discharged to Paerdegat Basin. As a result, the facility satisfies this performance metric.

Water Quality – Dissolved Oxygen

Dissolved oxygen was monitored at two locations within Paerdegat Basin during 2012, as described in Section 2.4. Results of this sampling show excursions below the ≥ 4.0 mg/L Class I criterion at both locations. However, the expected benefits of the Facility Plan will not be attainable until all elements are implemented, including dredging of the basin. Modeling analyses of the tank's impact on DO at station PB2 also shows minimum DO levels below 4.0 mg/L (see Table 2-17), but indicate that the tank improves minimum monthly DO by as much as 1.5 mg/L and improves monthly attainment of the applicable standards by as much as 5 percentage points in July, so that overall annual attainment of the applicable standard is approximately 94 percent, which meets the 90-percent attainment performance metric.

Water Quality – Pathogens

Fecal coliform concentration was monitored at two locations within Paerdegat Basin during 2012, as described in Section 2.4. Results of this sampling show a few discrete samples above the Class I standard of less than 2,000 cells/100mL, although the geometric mean of the available samples is lower than 2,000 cells/100mL. Modeling results (see Table 2-15 and 2-16) indicate that the waterbody should meet the applicable standards each month, thereby meeting this performance metric.